

Interactive Unit Reviews

Compiled by Zachary Miller

For

EARTH SCIENCE

The Physical Setting
SECOND EDITION

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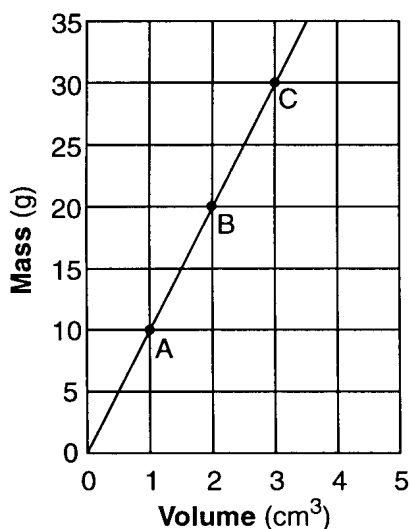
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Contents

Unit 1: Earth Measures and Models—Chapters 1 through 3	1
Unit 2: Minerals, Rocks and Resources—Chapters 4 through 6	10
Unit 3: Weathering and Erosion—Chapters 7 and 8	19
Unit 4: Water Shapes Earth’s Surface—Chapters 9 through 13	26
Unit 5: Earth’s Internal Heat Engine—Chapters 14 through 16	34
Unit 6: Revealing Earth’s History—Chapters 17 and 18	43
Unit 7: The Dynamic Atmosphere—Chapters 19 through 24	51
Unit 8: Earth and Beyond—Chapters 25 through 28	60

- 1 The graph below shows the relationship between mass and volume for three samples, *A*, *B*, and *C*, of a given material.



What is the density of this material?

- (1) 1.0 g/cm^3 (3) 10.0 g/cm^3
 (2) 5.0 g/cm^3 (4) 20.0 g/cm^3
- 2 The data table below shows the density of four different mineral samples.

Data Table

Mineral	Density (g/cm^3)
corundum	4.0
galena	7.6
hematite	5.3
quartz	2.7

A student accurately measured the mass of a sample of one of the four minerals to be 294.4 grams and its volume to be 73.6 cm^3 . Which mineral sample did the student measure?

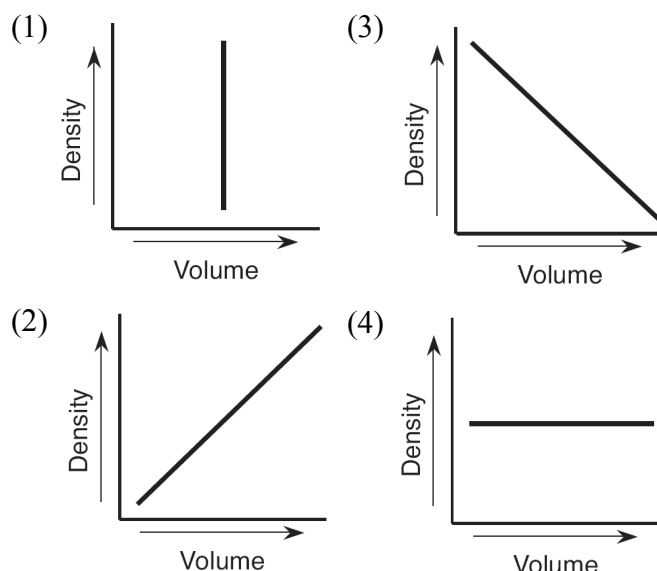
- (1) corundum (3) hematite
 (2) galena (4) quartz
- 3 The Earth's actual shape is most correctly described as
- (1) a circle (3) an oblate sphere
 (2) a perfect sphere (4) an eccentric ellipse

- 4 The data table below shows the mass and volume of three samples of the same mineral. [The density column is provided for student use.]

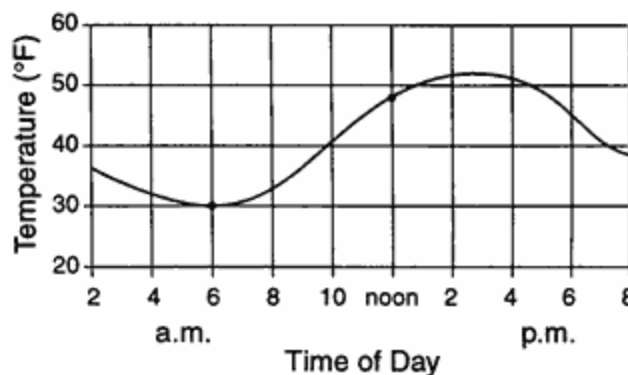
Data Table

Sample	Mass (g)	Volume (cm^3)	Density (g/cm^3)
A	50	25	
B	100	50	
C	150	75	

Which graph best represents the relationship between the density and the volume of these mineral samples?



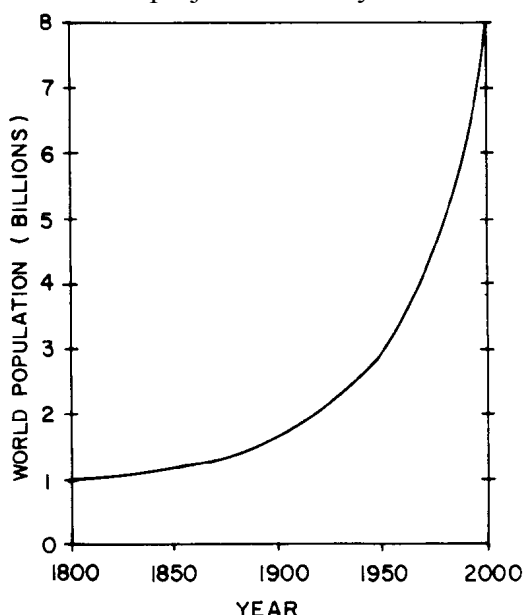
- 5 The graph below shows temperature readings for a day in April.



The average rate of temperature change, in Fahrenheit degrees per hour, between 6 A.M. and noon was

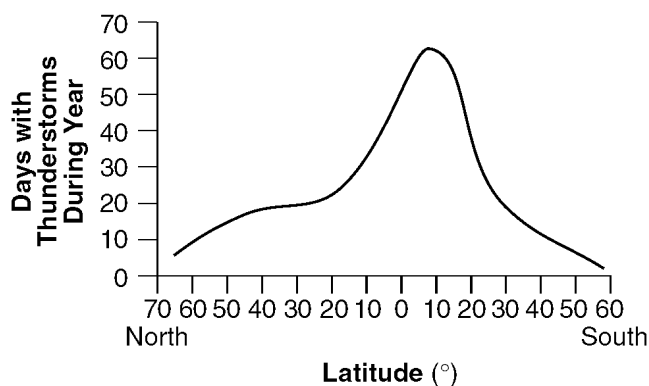
- (1) $6^\circ/\text{hr}$ (2) $8^\circ/\text{hr}$ (3) $3^\circ/\text{hr}$ (4) $18^\circ/\text{hr}$

- 6 The graph below shows world population beginning in the year 1800 and projected to the year 2000.



The graph shows the greatest increase in population between

- (1) 1825 and 1850 (3) 1925 and 1950
(2) 1875 and 1900 (4) 1975 and 2000
- 7 The graph below shows the average number of days each year that thunderstorms occur at different latitudes on Earth.



According to the graph, what is the approximate number of days each year that thunderstorms occur at 40°N latitude?

- (1) 8 days (3) 24 days
(2) 18 days (4) 32 days

- 8 The best evidence that the Earth has a spherical shape is provided by

- (1) photographs of the Earth taken from space satellites
(2) the amount of daylight received at the North Pole on June 21
(3) the changing orbital speed of the Earth in its orbit around the Sun
(4) the cyclic change of seasons

- 9 The data table below shows the origin depths of all large-magnitude earthquakes over a 20-year period.

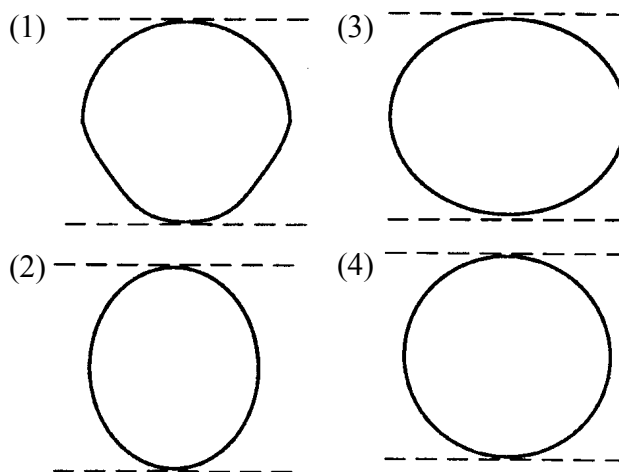
Data Table

Depth Below Surface (km)	Number of Earthquakes
0–33	27,788
34–100	17,585
101–300	7,329
301–700	3,167

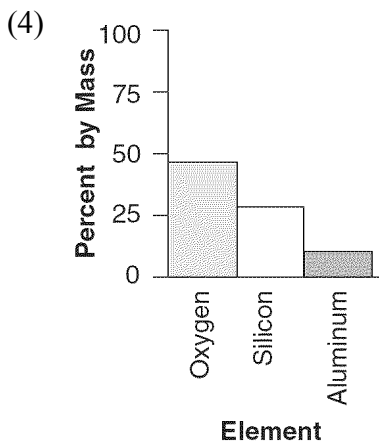
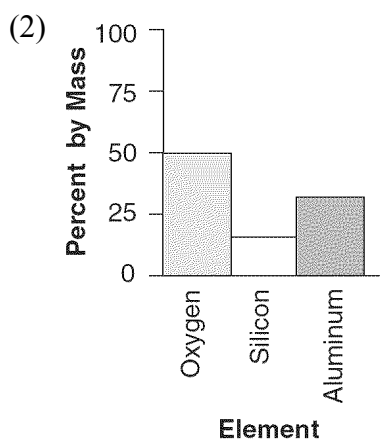
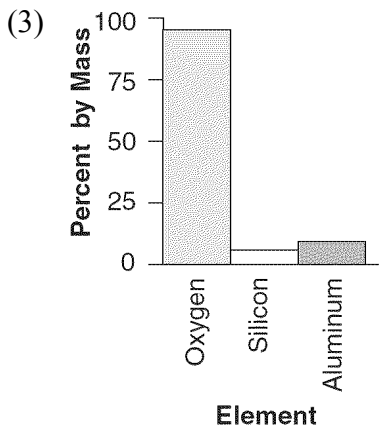
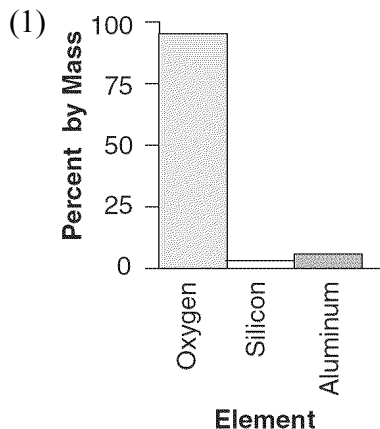
According to these data, most of these earthquakes occurred within Earth's

- (1) lithosphere (3) stiffer mantle
(2) asthenosphere (4) outer core

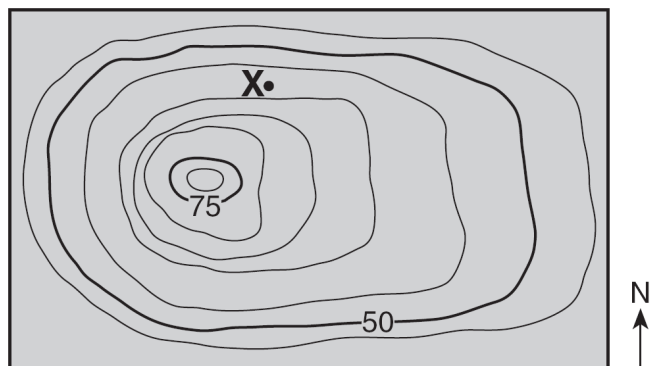
- 10 Which diagram most accurately shows the cross-sectional shape of the Earth?



11 Which graph correctly represents the three most abundant elements, by mass, in Earth's crust?



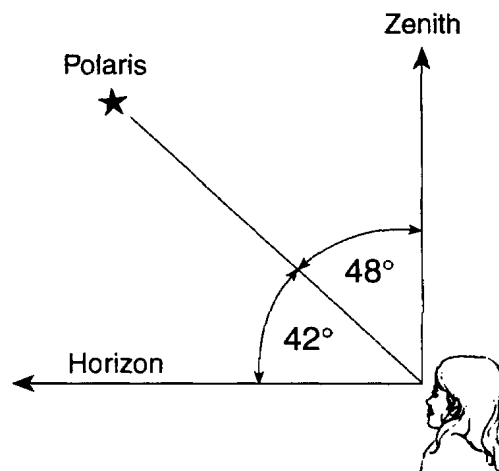
12 Point *X* is a location on the topographic map below. Elevations are measured in meters.



What is a possible elevation, in meters, of point *X*?

- (1) 55 (2) 57 (3) 68 (4) 70

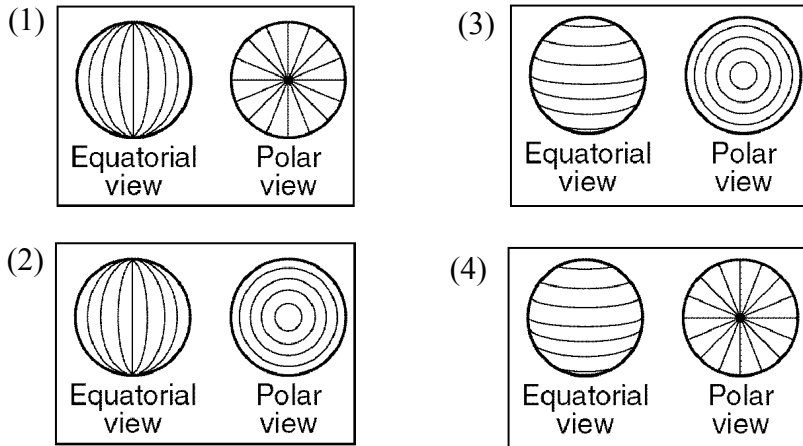
13 The diagram below shows a student in New York State observing *Polaris*.



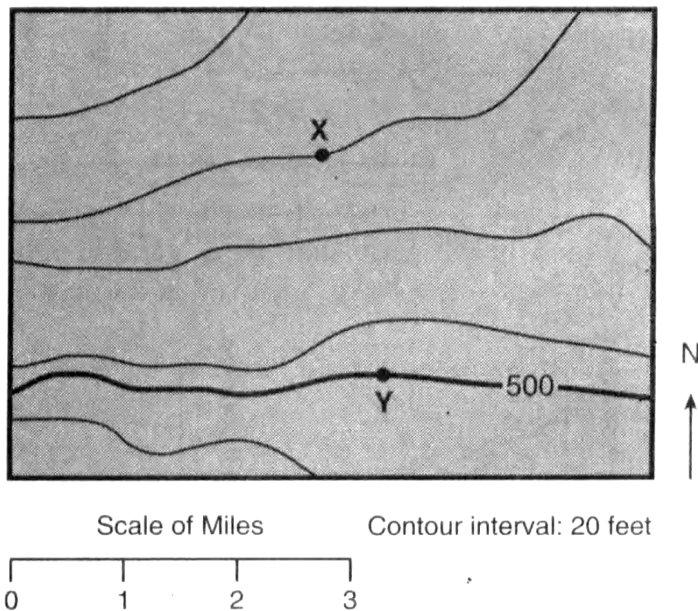
The student is located nearest to which city in New York State?

- (1) Plattsburgh (3) New York City
(2) Albany (4) Kingston

14 The lines on which set of views best represent Earth's latitude system?



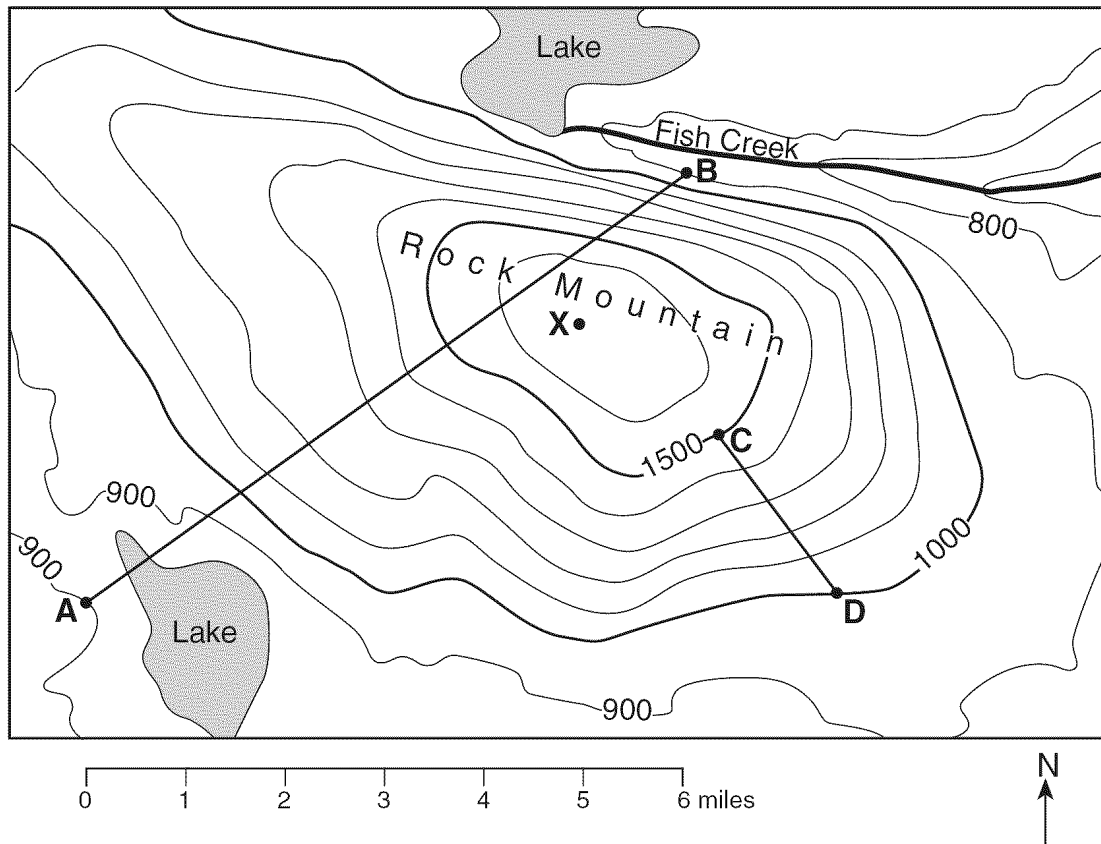
15 The topographic map below shows locations *X* and *Y*.



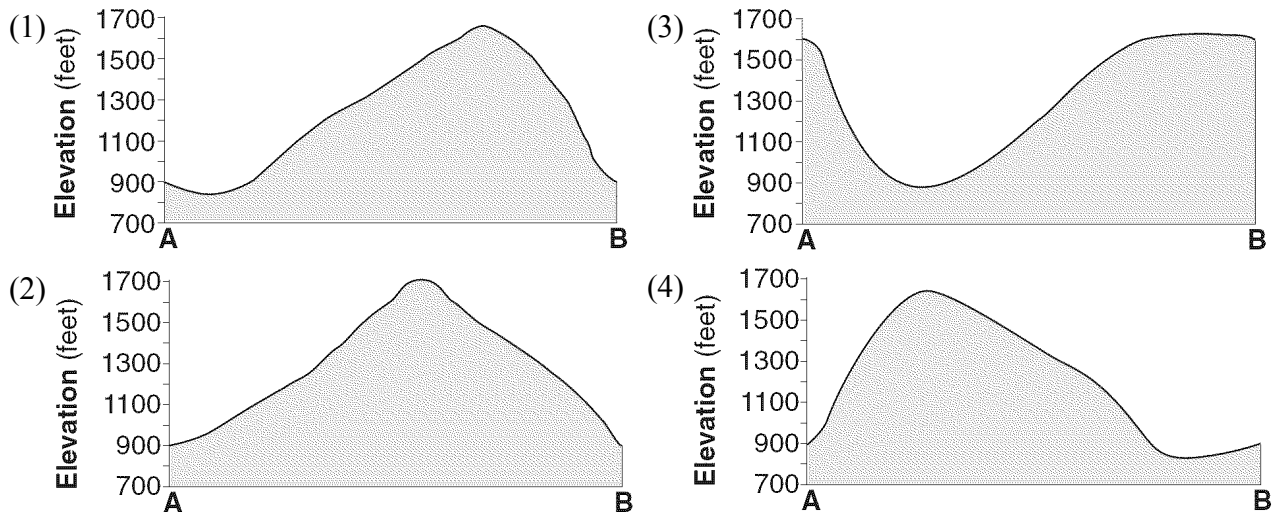
What is the approximate gradient between *X* and *Y*?

- (1) 15 ft/mi (3) 30 ft/mi
(2) 20 ft/mi (4) 60 ft/mi

Base your answer to the following question on the topographic map below. Points *A*, *B*, *C*, *D*, and *X* represent locations on the map. Elevations are measured in feet.



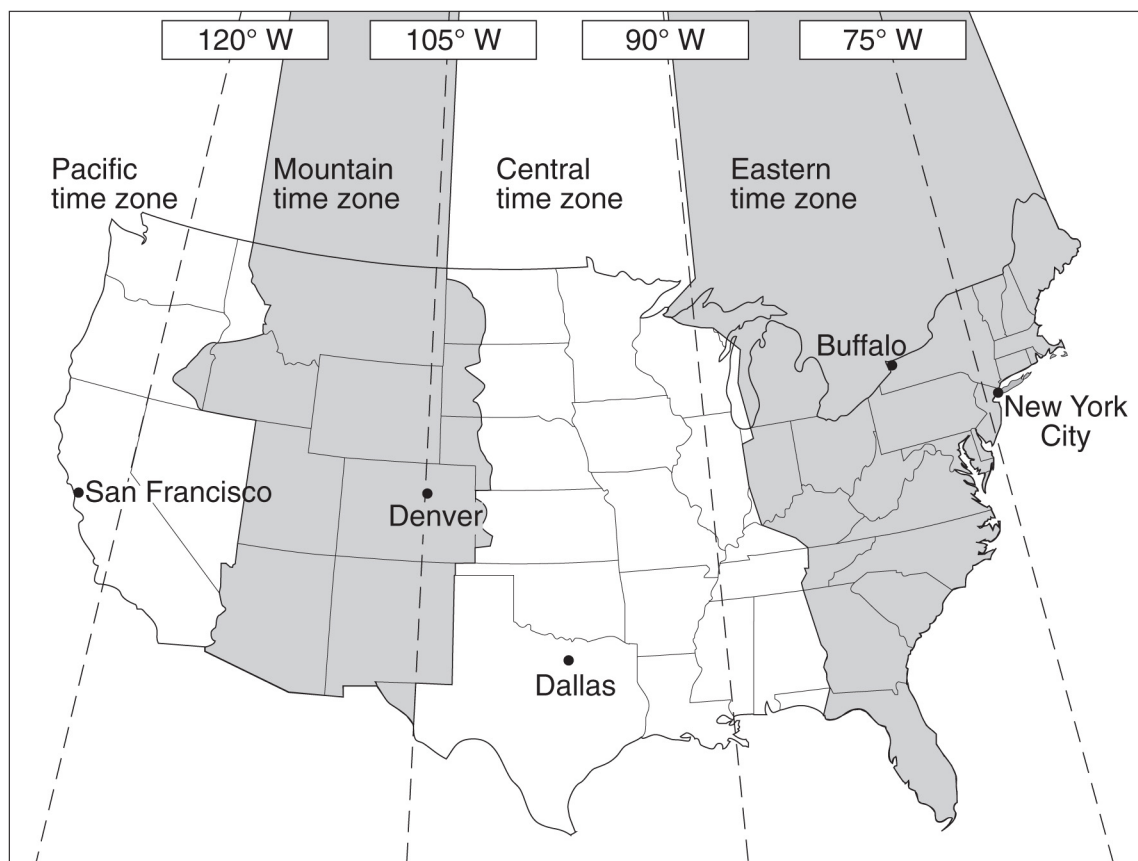
16 Which cross section best represents the profile along straight line *AB*?



Base your answer to questions 17 and 18 on passage and time zones map shown below.

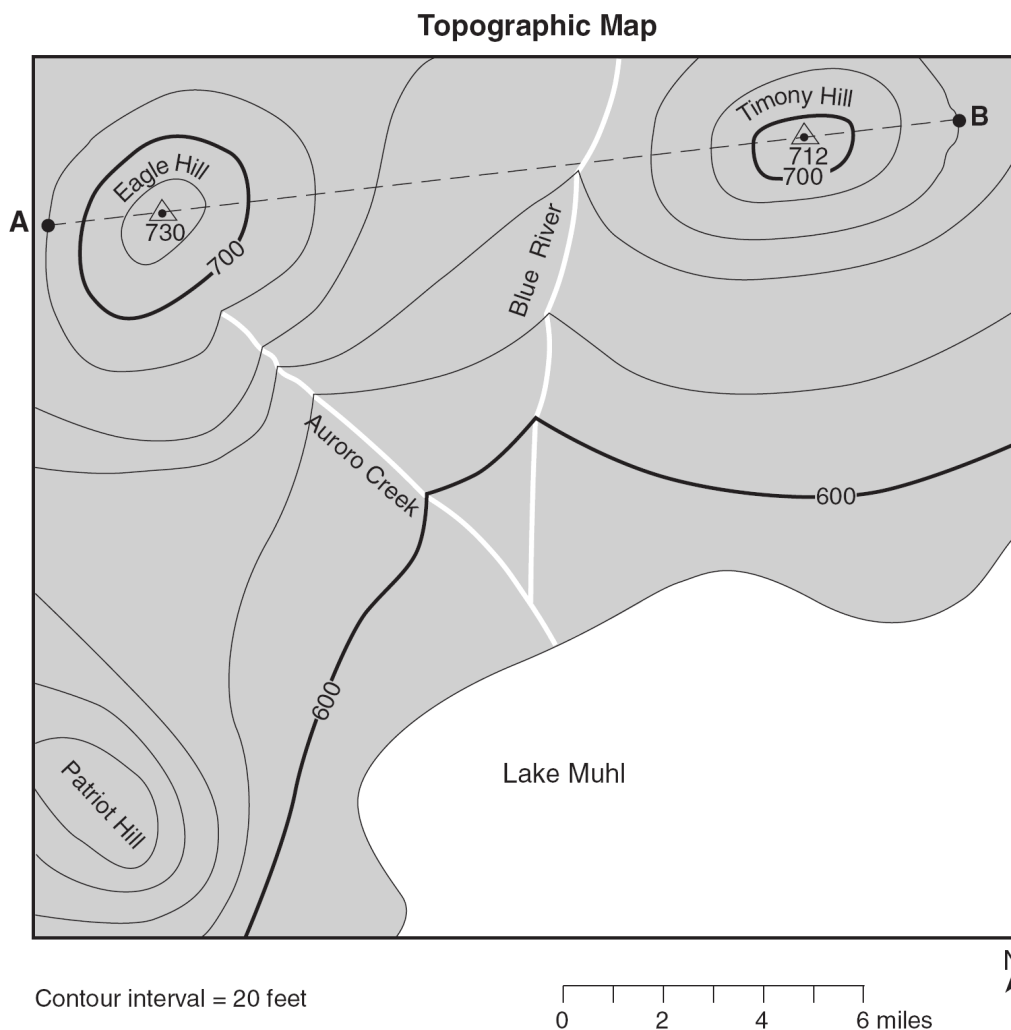
Time Zones

In 1883, Earth was divided into 24 time zones. The United States (excluding Alaska and Hawaii) has four time zones, which are indicated by different shadings on the map. Each zone is roughly centered on lines of longitude that are 15° apart. These lines are shown as dashed lines on the map. Most locations within a time zone have the same time. This time is called standard time. As you move to the west, the time in each zone is one hour earlier than the previous time zone



- ? 17 Explain, in terms of Earth's rotation, why the time zones are 15° of longitude apart.
- ? 18 When it is 10 P.M. in New York City, what time is it in San Francisco?

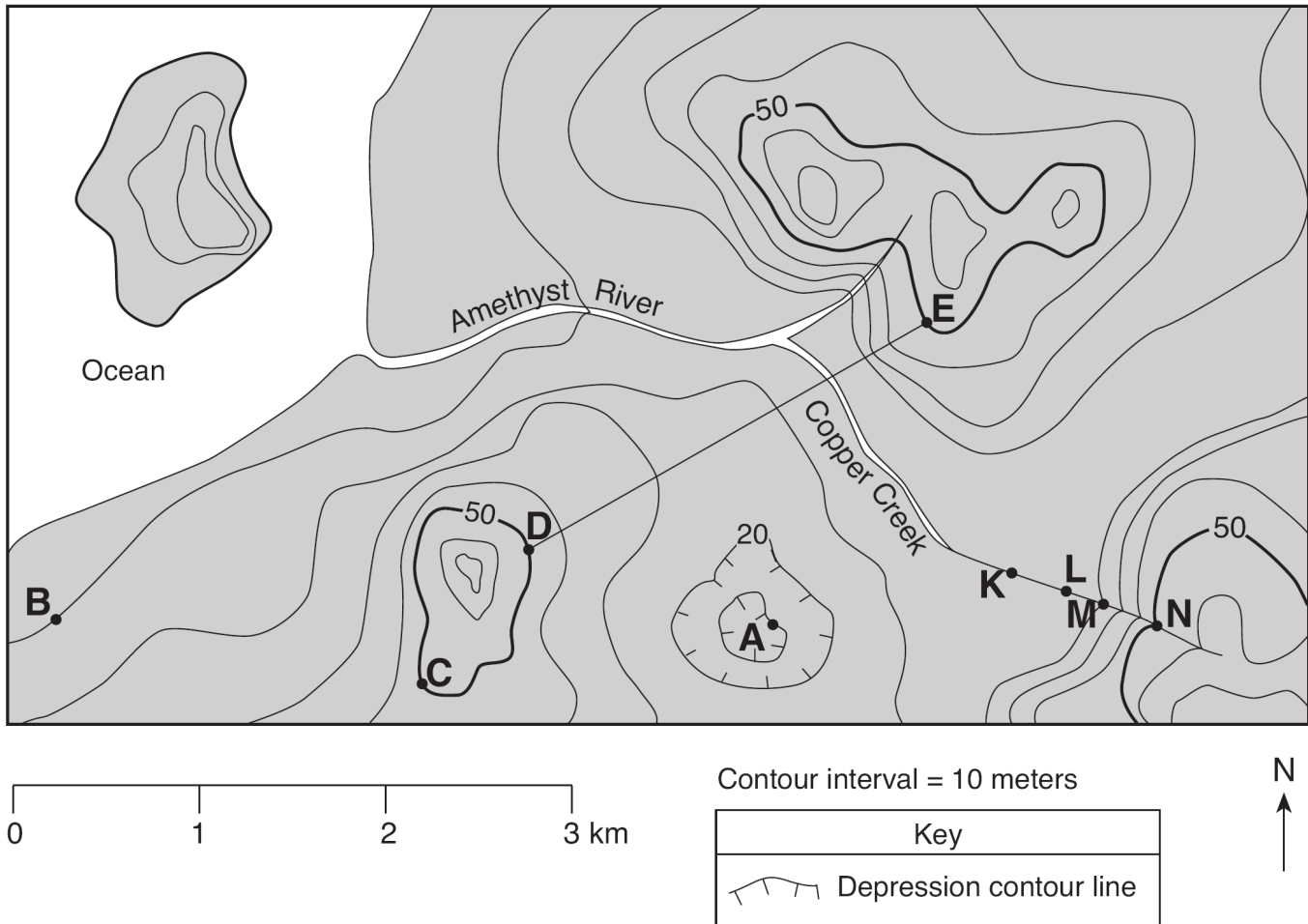
Base your answer to the following question on the topographic map below. Points *A* and *B* are reference points on the map. The Δ symbols show the highest elevations on Eagle Hill and Timony Hill. Elevations are shown in feet.



- 19 On the grid below, construct a topographic profile along line *AB* by plotting an **X** for the elevation of each contour line that crosses line *AB*. Connect the plotted **Xs** with a smooth, curved line to complete the profile. Points *A* and *B* have been plotted.



Base your answer to the following question on the topographic map shown below. Letters *A*, *B*, *C*, *D*, and *E* represent locations on Earth's surface. Letters *K*, *L*, *M*, and *N* are locations along Copper Creek. Elevations are measured in meters.



- 20 Explain how the map indicates that Copper Creek flows faster between points *N* and *M* than between points *L* and *K*.

19 [2] Allow a maximum of 2 credits, allocated as follows:

Allow 2 credits if the centers of ten or eleven student-plotted Xs are within the circles shown below and the Xs are correctly connected with a line that falls within the circles.

Allow 1 credit if the centers of only eight or nine student-plotted Xs are within the circles shown below and the Xs are correctly connected with a line that falls within the circles.

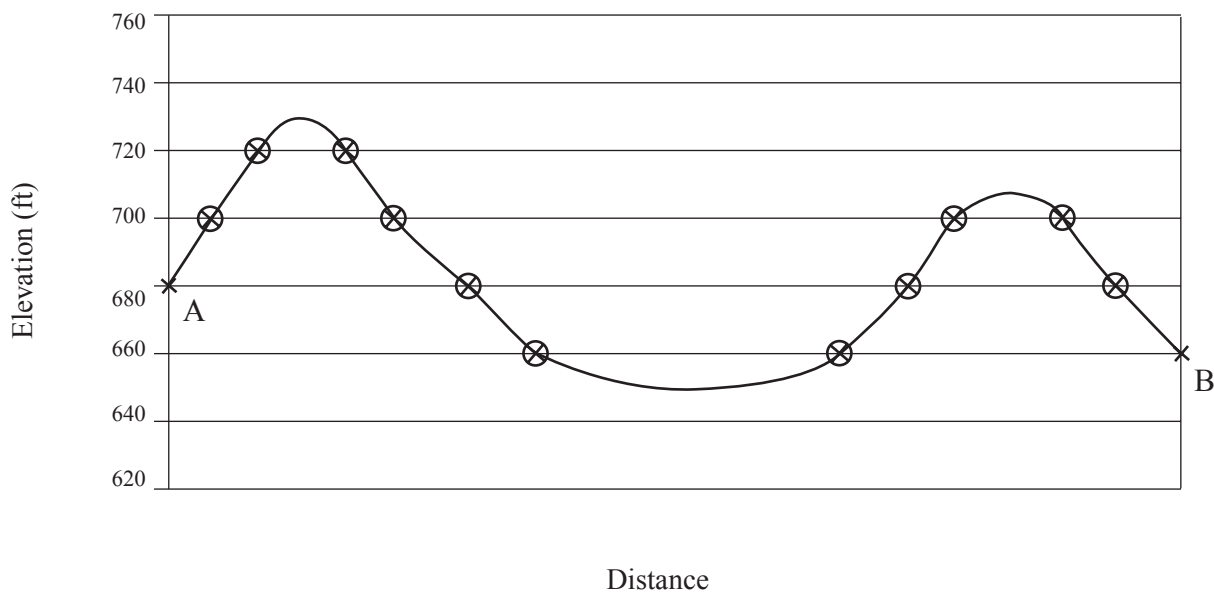
or

Allow 1 credit if the centers of ten or eleven student-plotted Xs are within the circles shown below but are not correctly connected with a line that falls within the circles.

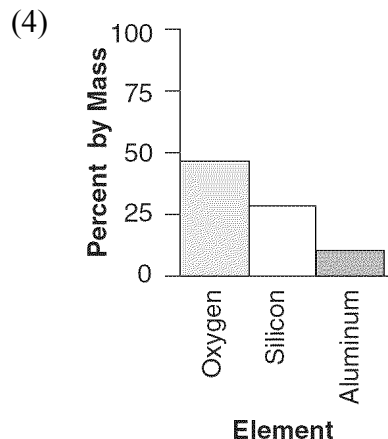
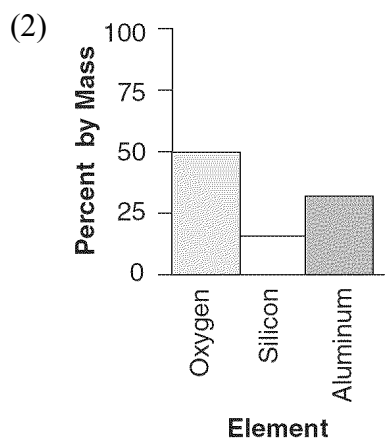
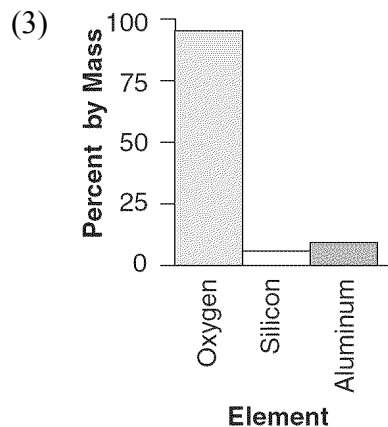
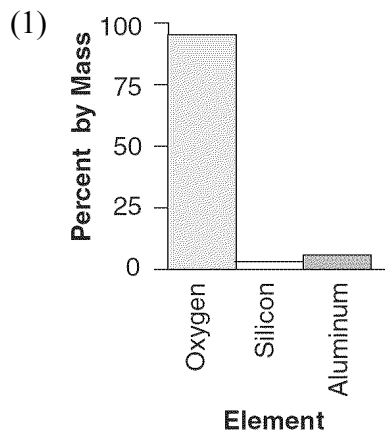
Note: Eagle Hill must be greater than 720 feet but less than 740 feet, and Timony Hill must be greater than 700 feet but less than 720 feet. The low point of the profile must be less than 660 feet, but greater than 640 feet.

It is recommended that an overlay be used to ensure uniformity in scoring.

Example of a 2-credit response:



1 Which graph correctly represents the three most abundant elements, by mass, in Earth's crust?



2 Which rock was most likely formed from pebble sized sediment deposited in shallow water at an ocean shoreline?

- (1) shale
- (2) basalt
- (3) siltstone
- (4) conglomerate

3 Which property best describes a rock which has formed from sediments?

- (1) crystalline structure
- (2) distorted structure
- (3) banding or zoning of minerals
- (4) fragmental particles arranged in layers

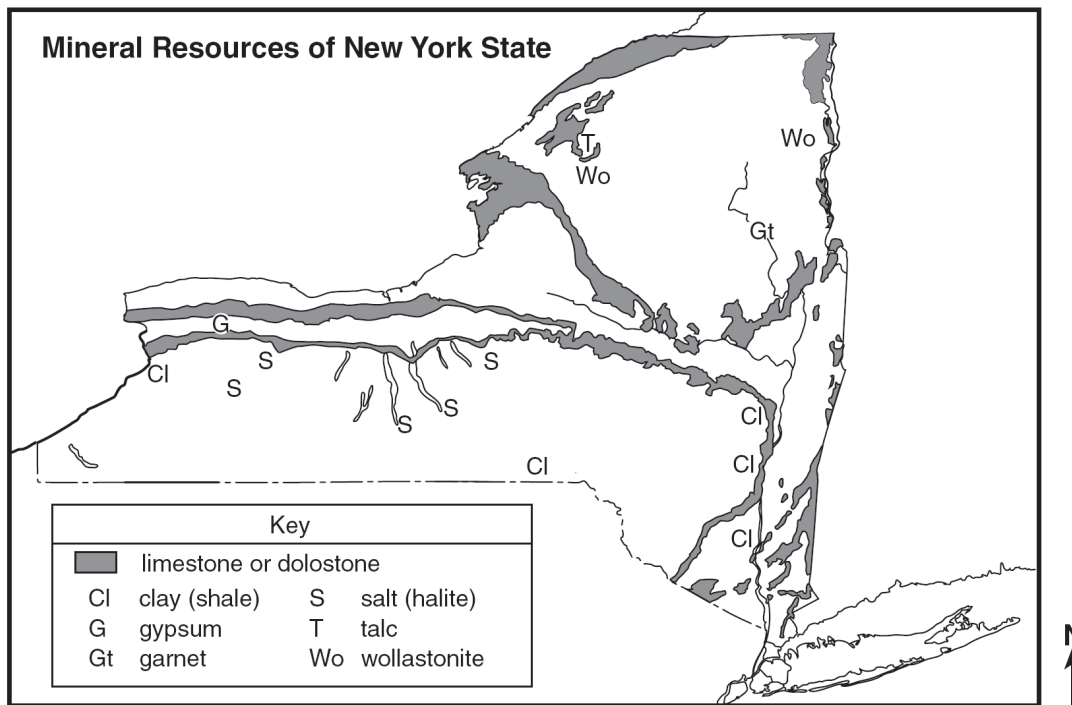
4 Where are the Earth's sedimentary rocks generally found?

- (1) in regions of recent volcanic activity
- (2) deep within the Earth's crust
- (3) along the mid-ocean ridges
- (4) as a thin layer covering much of the continents

5 What do most igneous, sedimentary, and metamorphic rocks have in common?

- (1) They are formed from molten material.
- (2) They are produced by heat and pressure.
- (3) They are composed of minerals.
- (4) They exhibit crystals, banding, and distinct layers.

6 Base your answer to the following question on



What is a common use for the mineral that is mined at the southern end of the two largest Finger Lakes?

- (1) making talcum powder
- (2) vulcanizing rubber
- (3) polishing jewelry
- (4) melting ice

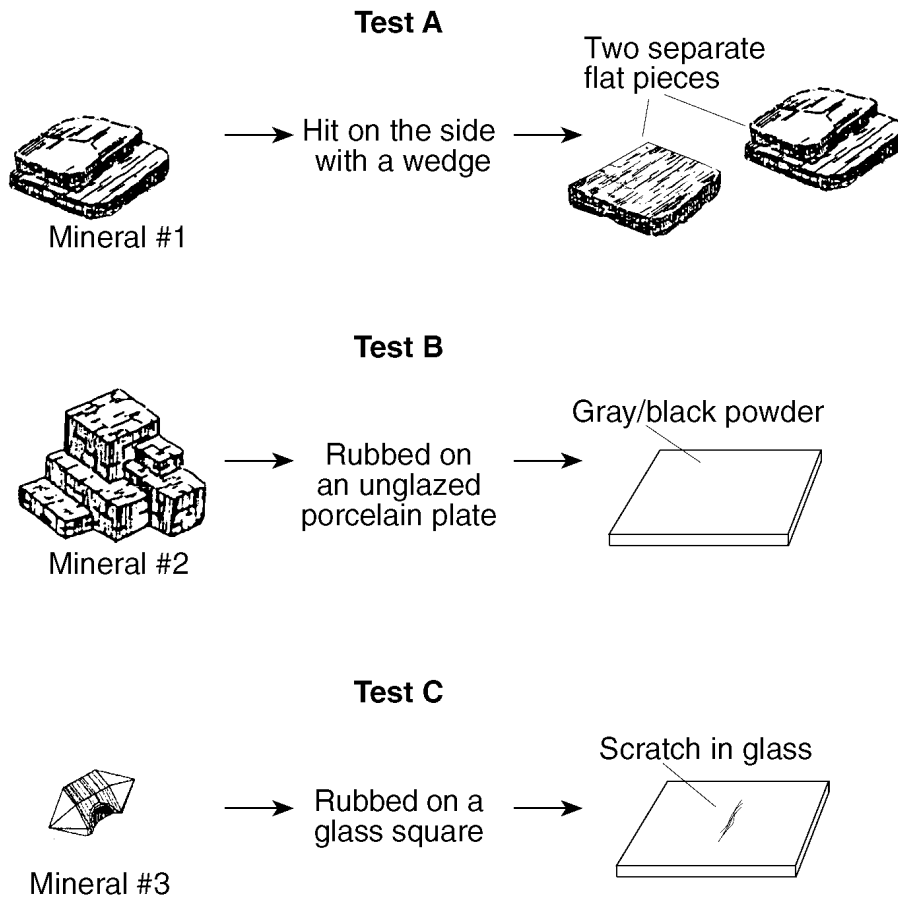
7 The photograph below shows a piece of halite that has been recently broken.



Which physical property of halite is demonstrated by this pattern of breakage?

- (1) hardness
- (2) streak
- (3) cleavage
- (4) luster

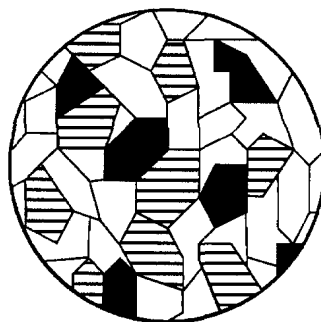
8 Base your answer to the following question on



Which sequence correctly matches each test, *A*, *B*, and *C*, with the mineral property tested?

- | | |
|--|--|
| (1) <i>A</i> —cleavage; <i>B</i> —streak; <i>C</i> —hardness | (3) <i>A</i> —streak; <i>B</i> —cleavage; <i>C</i> —hardness |
| (2) <i>A</i> —cleavage; <i>B</i> —hardness; <i>C</i> —streak | (4) <i>A</i> —streak; <i>B</i> —hardness; <i>C</i> —cleavage |

9 The diagram below shows the mineral composition of an igneous rock drawn actual size.

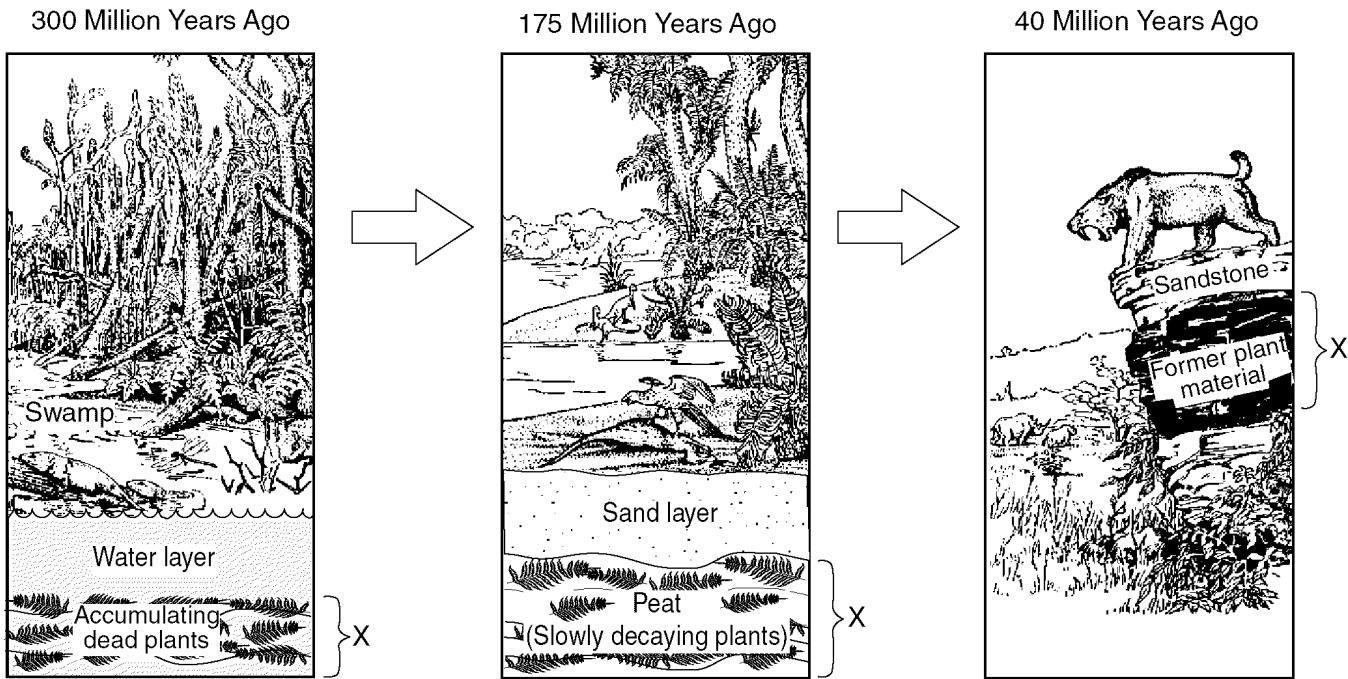


KEY TO MINERALS	
	PYROXENE
	PLAGIOCLASE FELDSPAR
	HORNBLENDE

This igneous rock is

- | | | | |
|------------|-------------|------------|--------------|
| (1) gabbro | (2) granite | (3) basalt | (4) rhyolite |
|------------|-------------|------------|--------------|

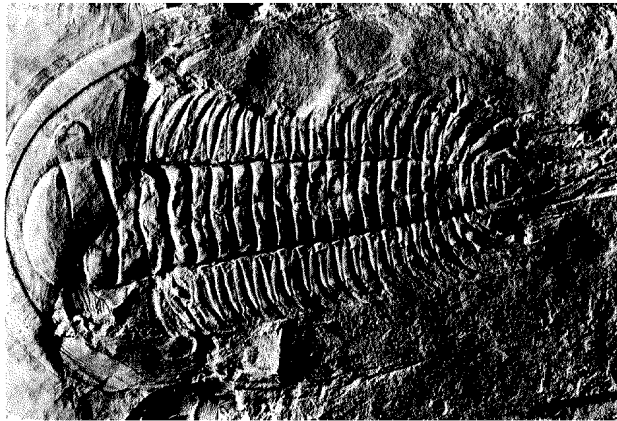
- 10 The sequence of diagrams below represents the gradual geologic changes in layer *X*, located just below Earth's surface.



Which type of sedimentary rock was formed at layer *X*?

- (1) conglomerate (2) shale (3) rock salt (4) coal

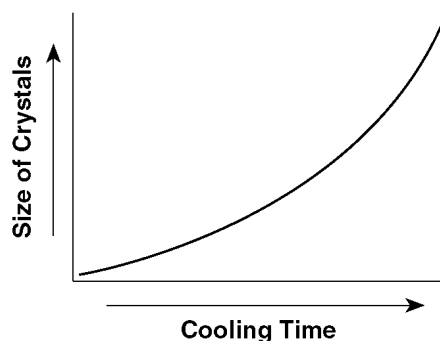
- 11 The fossil below was found in surface bedrock in the eastern United States.



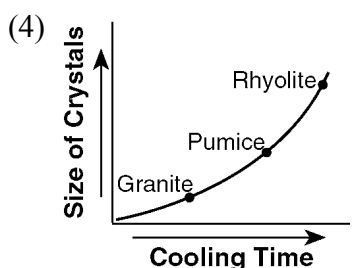
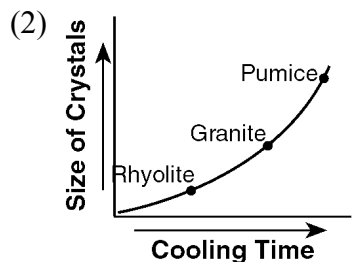
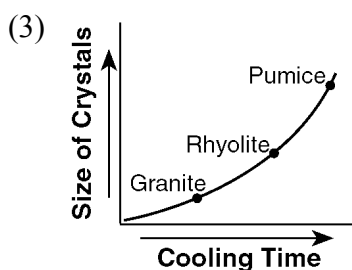
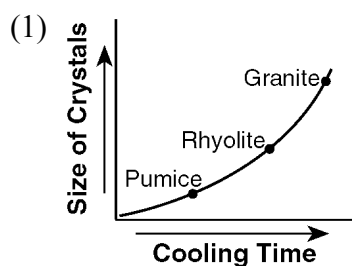
Which statement best describes the formation of the rock containing this fossil?

- (1) The rock was formed by the metamorphism of sedimentary rock deposited in a terrestrial environment during the Cretaceous Period.
- (2) The rock was formed by the compaction and cementation of sediments deposited in a terrestrial environment during the Triassic Period.
- (3) The rock was formed by the compaction and cementation of sediments deposited in a marine environment during the Cambrian Period.
- (4) The rock was formed from the solidification of magma in a marine environment during the Triassic Period.

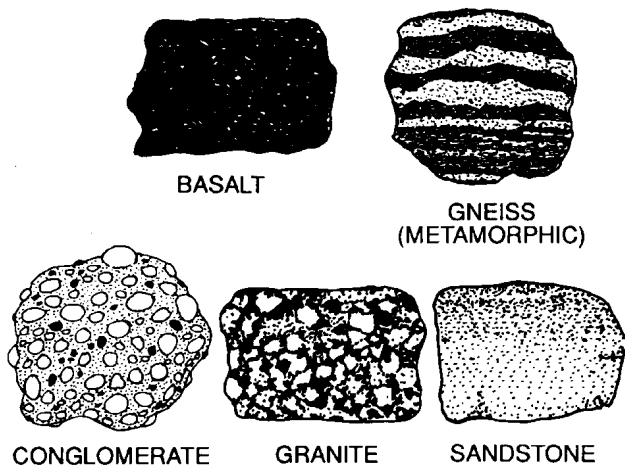
- 12 The graph below shows the relationship between the cooling time of magma and the size of the crystals produced.



Which graph correctly shows the relative positions of the igneous rocks granite, rhyolite, and pumice?



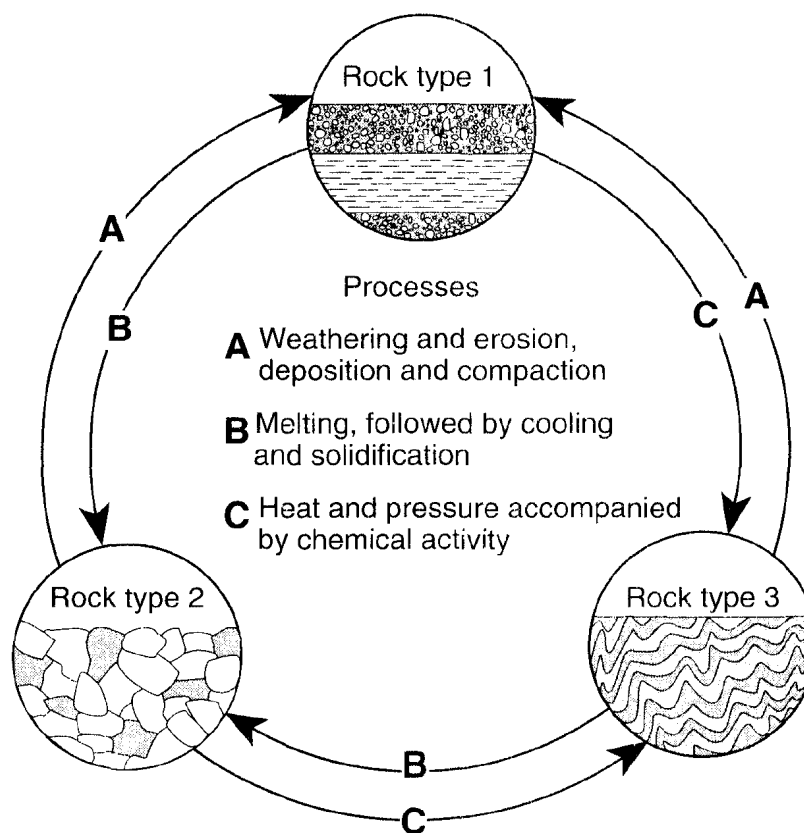
- 13 Base your answer to the following question on



If granite were subjected to intense heat and pressure, it would most likely change to

- (1) conglomerate (2) sandstone (3) gneiss (4) basalt

- 14 The diagram below represents geological processes that act continuously on Earth to form different rock types.



Which table correctly classifies each rock type?

(1)

Rock Type	Classification
1	sedimentary
2	metamorphic
3	igneous

(3)

Rock Type	Classification
1	metamorphic
2	igneous
3	sedimentary

(2)

Rock Type	Classification
1	sedimentary
2	igneous
3	metamorphic

(4)

Rock Type	Classification
1	igneous
2	metamorphic
3	sedimentary

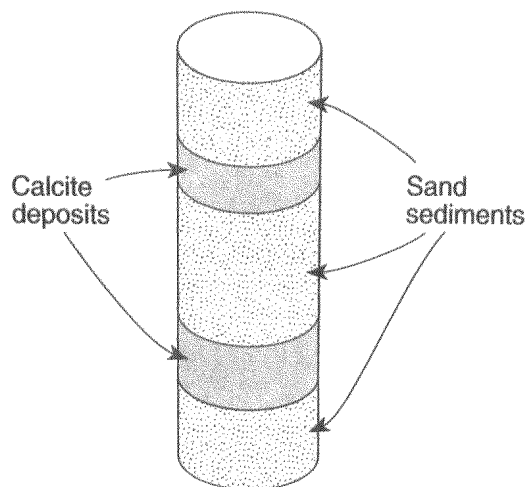
15 Base your answer to the following question on

Moh's Mineral Hardness Scale		Approximate Hardness of Common Objects	
Talc	1	Fingernail (2.5)	
Gypsum	2	Copper penny (3.5)	
Calcite	3	Iron nail (4.5)	
Fluorite	4	Glass (5.5)	
Apatite	5	Steel file (6.5)	
Feldspar	6	Streak plate (7.0)	
Quartz	7		
Topaz	8		
Corundum	9		
Diamond	10		

Which statement is best supported by this scale?

- (1) A fingernail will scratch calcite, but not quartz.
- (2) A fingernail will scratch quartz, but not calcite.
- (3) A piece of glass can be scratched by quartz, but not by calcite.
- (4) A piece of glass can be scratched by calcite, but not by quartz.

16 The diagram below shows a drill core of sediment that was taken from the bottom of a lake.



Which types of rock would most likely form from compaction and cementation of these sediments?

- (1) sandstone and limestone
- (2) shale and coal
- (3) breccia and rock salt
- (4) conglomerate and siltstone

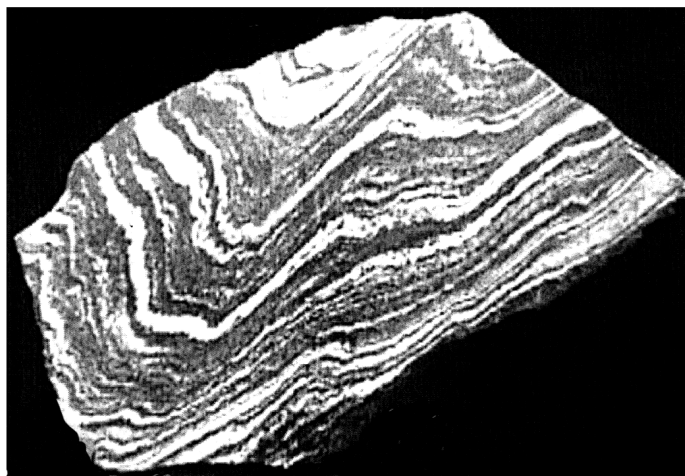
- 17 Below is a list of some mineral resources and the number of years that supplies are estimated to last (supply time) if use continues at the current rate.

Mineral Resources' Future

Mineral Resource	Estimated Supply Time
Salt, magnesium metal	almost infinite
Lime, silicon	thousands of years
Potash, cobalt	200+ years
Manganese ore	200+ years
Iron ore	100 to 200 years
Chromite, feldspar	100 to 200 years
Bauxite (aluminum ore)	50 to 100 years
Phosphate rock, nickel	50 to 100 years
Copper, mercury	less than 50 years
Zinc, lead	less than 50 years

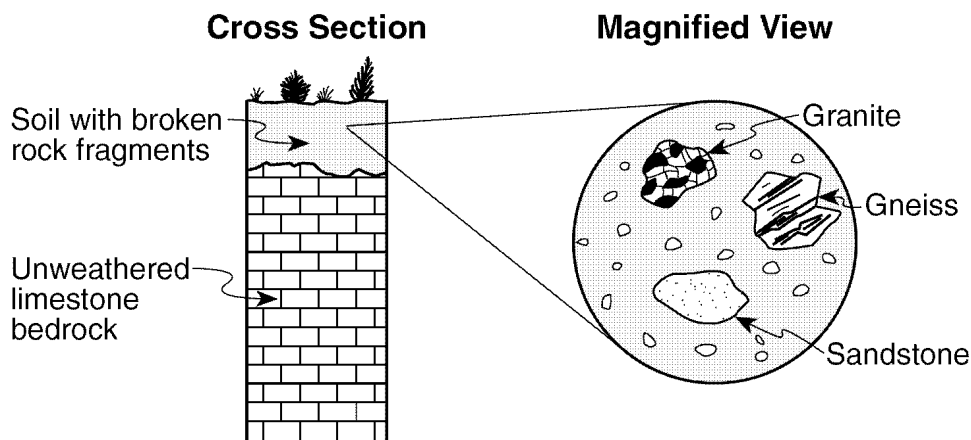
- ? State *one* way humans could increase the estimated supply time for many of these resources.

- 18 Base your answer to the following question on



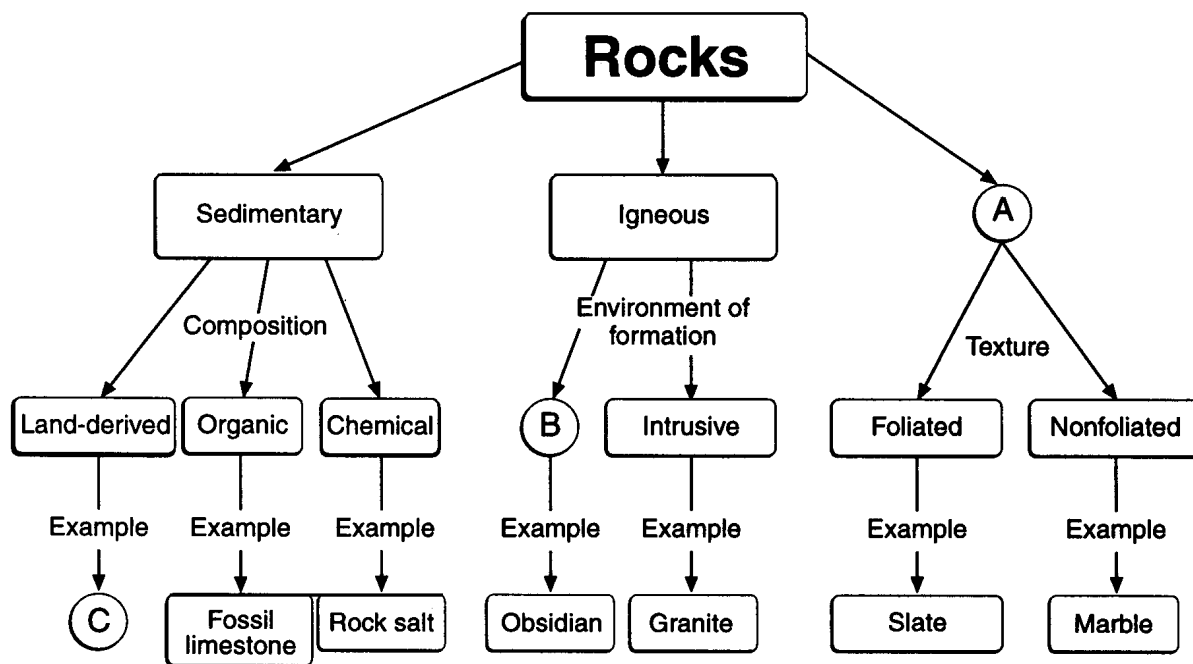
- ? What observable characteristic could be used to identify this rock sample as gneiss?

- 19 Base your answer to the following question on



- ? Identify *one* mineral that could be found in all three rock fragments shown in the magnified view.

20 The chart below shows the different rock families and their subdivisions. The circled letters, *A*, *B*, and *C*, indicate parts of the chart that have not been completed.



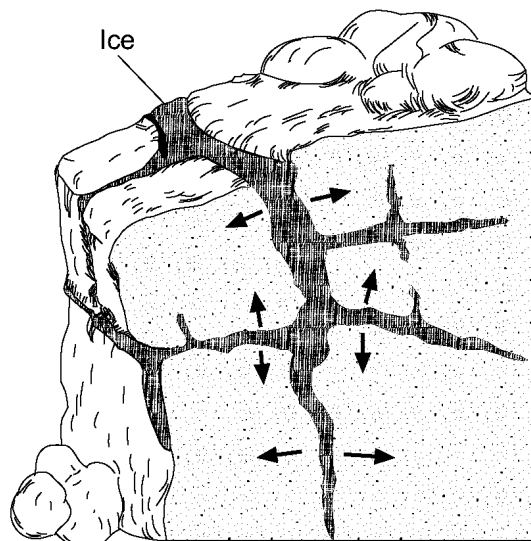
? Complete the chart by writing the missing terms in the spaces labeled *A*, *B*, and *C* below

A _____

B _____

C _____

- 1 The diagram below shows granite bedrock with cracks. Water has seeped into the cracks and frozen. The arrows represent the directions in which the cracks have widened due to weathering.



Which statement best describes the physical weathering shown by the diagram?

- (1) Enlargement of the cracks occurs because water expands when it freezes.
- (2) This type of weathering occurs only in bedrock composed of granite.
- (3) The cracks become wider because of chemical reactions between water and the rock.
- (4) This type of weathering is common in regions of primarily warm and humid climates.

- 2 Which type of climate has the greatest amount of rock weathering caused by frost action?

- (1) a wet climate in which temperatures remain below freezing
- (2) a wet climate in which temperatures alternate from below freezing to above freezing
- (3) a dry climate in which temperatures remain below freezing
- (4) a dry climate in which temperatures alternate from below freezing to above freezing

- 3 In which climate would the chemical weathering of limestone occur most rapidly?

- (1) cold and dry
- (2) cold and humid
- (3) warm and dry
- (4) warm and humid

- 4 Which factor has the greatest influence on the weathering rate of Earth's surface bedrock?

- (1) local air pressure
- (2) angle of insolation
- (3) age of the bedrock
- (4) regional climate

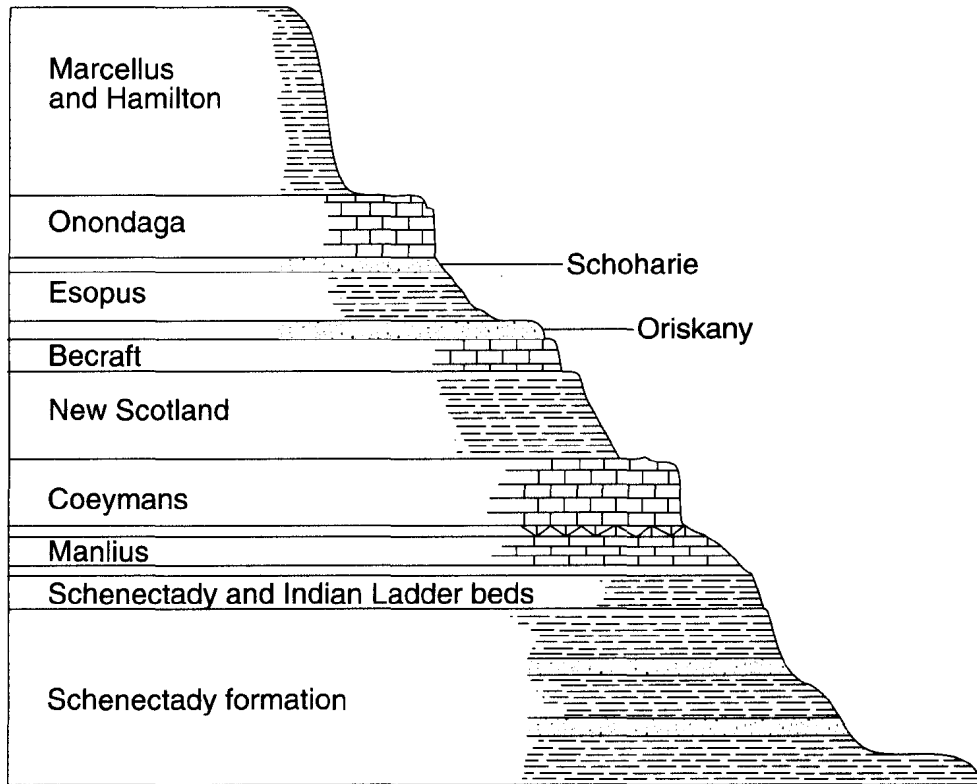
- 5 Which activity demonstrates chemical weathering?

- (1) freezing of water in the cracks of a sandstone sidewalk
- (2) abrasion of a streambed by tumbling rocks
- (3) grinding of talc into a powder
- (4) dissolving of limestone by acid rain

- 6 Water is a major agent of chemical weathering because water

- (1) cools the surroundings when it evaporates
- (2) dissolves many of the minerals that make up rocks
- (3) has a density of about one gram per cubic centimeter
- (4) has the highest specific heat of all common earth materials

7 Base your answer to the following question on



Which formations appear to be the most resistant to weathering?

- (1) Esopus and Oriskany
- (2) Onondaga and Coeymans
- (3) Schoharie, and Marcellus and Hamilton
- (4) New Scotland, and Schenectady and Indian Ladder beds

8 Which factors most directly control the development of soils?

- (1) soil particle sizes and method of deposition
- (2) bedrock composition and climate characteristics
- (3) direction of prevailing winds and storm tracks
- (4) earthquake intensity and volcanic activity

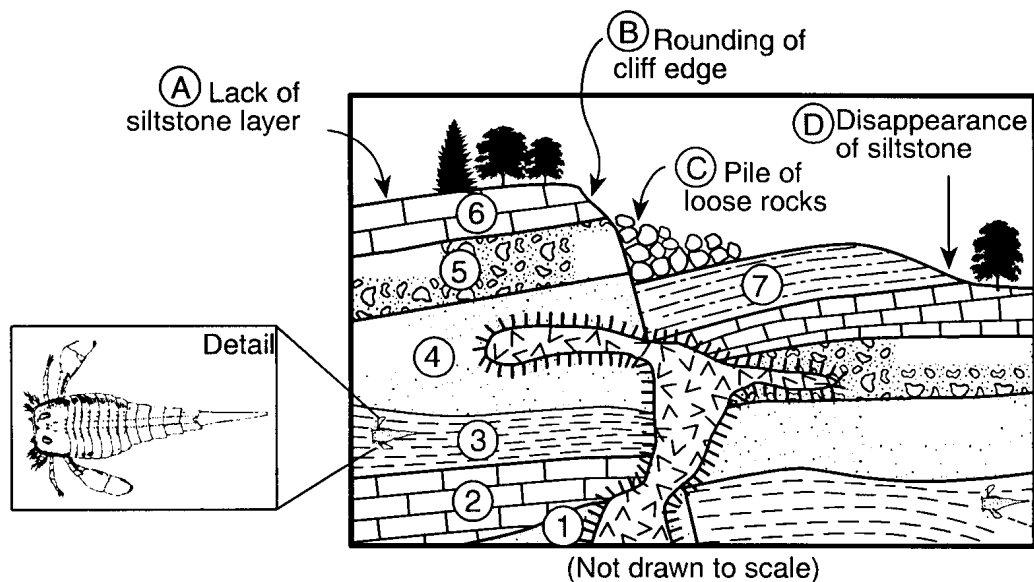
9 What occurs when a rock is crushed into a pile of fragments?

- (1) The total surface area decreases and chemical composition changes.
- (2) The total surface area decreases and chemical composition remains the same.
- (3) The total surface area increases and chemical composition changes.
- (4) The total surface area increases and chemical composition remains the same.

10 A large, scratched boulder is found in a mixture of unsorted, smaller sediments forming a hill in central New Jersey. Which agent of erosion most likely transported and then deposited this boulder?

- (1) wind
- (2) a glacier
- (3) ocean waves
- (4) running water

11 Base your answer to the following question on

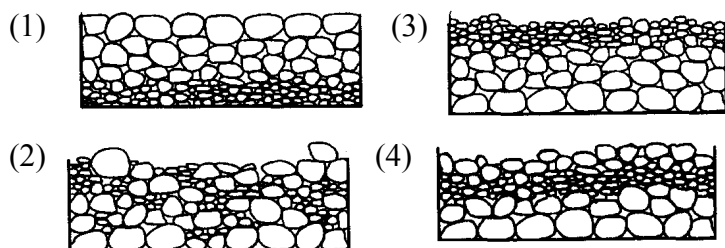


Key	
	Siltstone
	Shale
	Limestone
	Conglomerate
	Sandstone
	Basalt
	Contact metamorphism

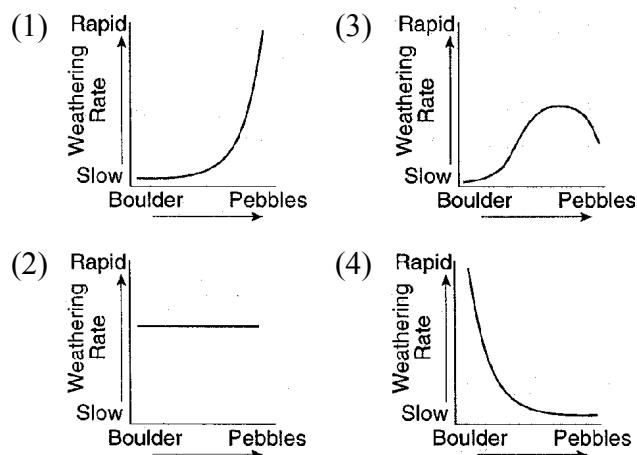
Which landscape features provide evidence that weathering and erosion were likely to have occurred?

- (1) *A* and *D*, only
 (2) *B* and *C*, only
 (3) *A*, *C*, and *D*, only
 (4) *A*, *B*, *C*, and *D*

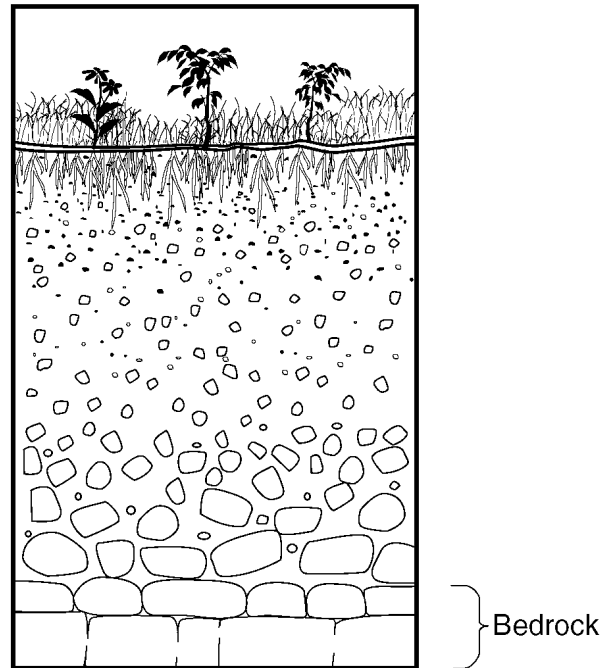
12 Quartz particles of varying sizes are dropped at the same time into deep, calm water. Which cross section best represents the settling pattern of these particles?



13 Which graph best represents the chemical weathering rate of a limestone boulder as the boulder is broken into pebble-sized particles?



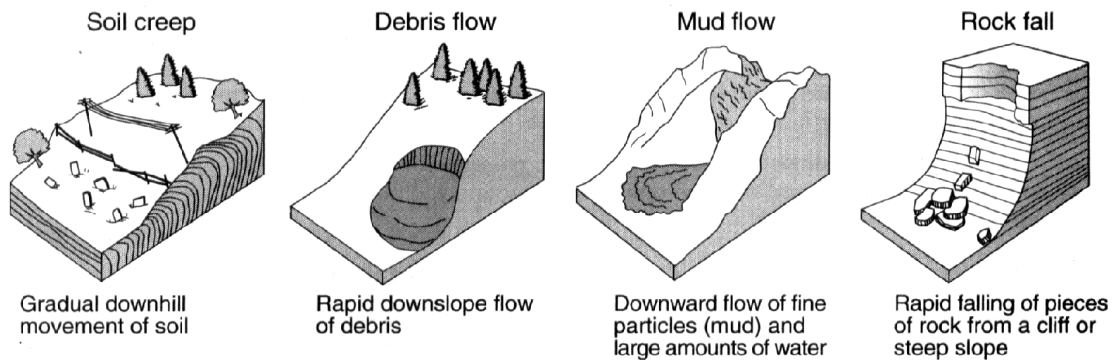
14 The cross section below shows a soil profile.



This soil was formed primarily by

- (1) erosion by glaciers
- (2) erosion by running water
- (3) capillarity and human activity
- (4) weathering and biological activity

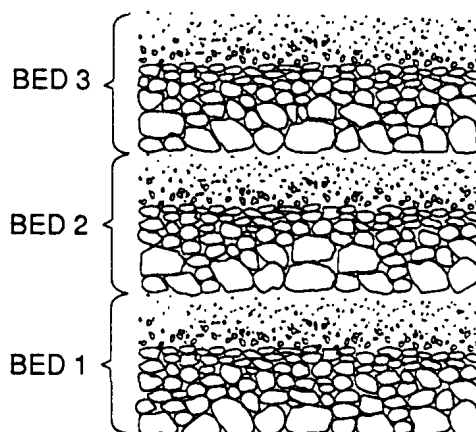
15 The diagrams below represent four different examples of one process that transports sediments.



Which process is shown in these diagrams?

- (1) chemical weathering
- (2) wind action
- (3) mass movement
- (4) rock abrasion

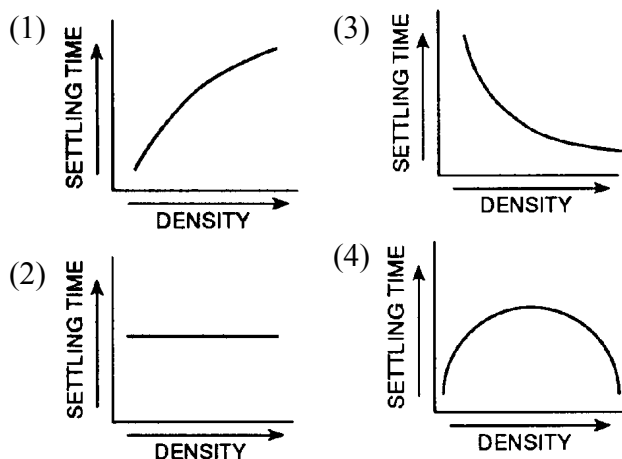
16 The diagram below shows three beds of sediment deposited at different times in a quiet body of water.



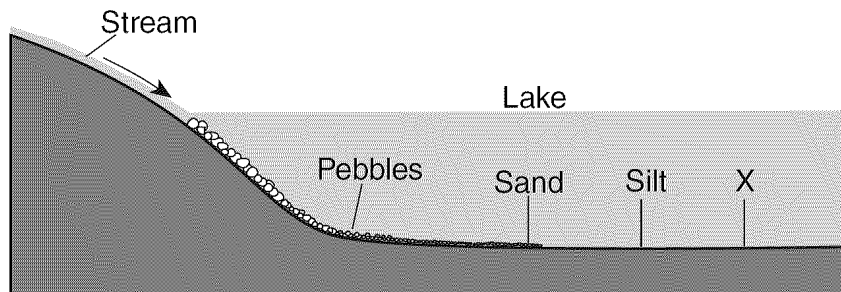
The sediment deposited in each bed is best described as

- (1) sorted mainly according to particle size (3) a mixture of sorted and unsorted particles
(2) sorted mainly according to particle shape (4) showing no evidence of sorting

17 Which graph shows the relationship between the density of particles and their settling time in still water? [Assume that the particles have the same size and shape.]



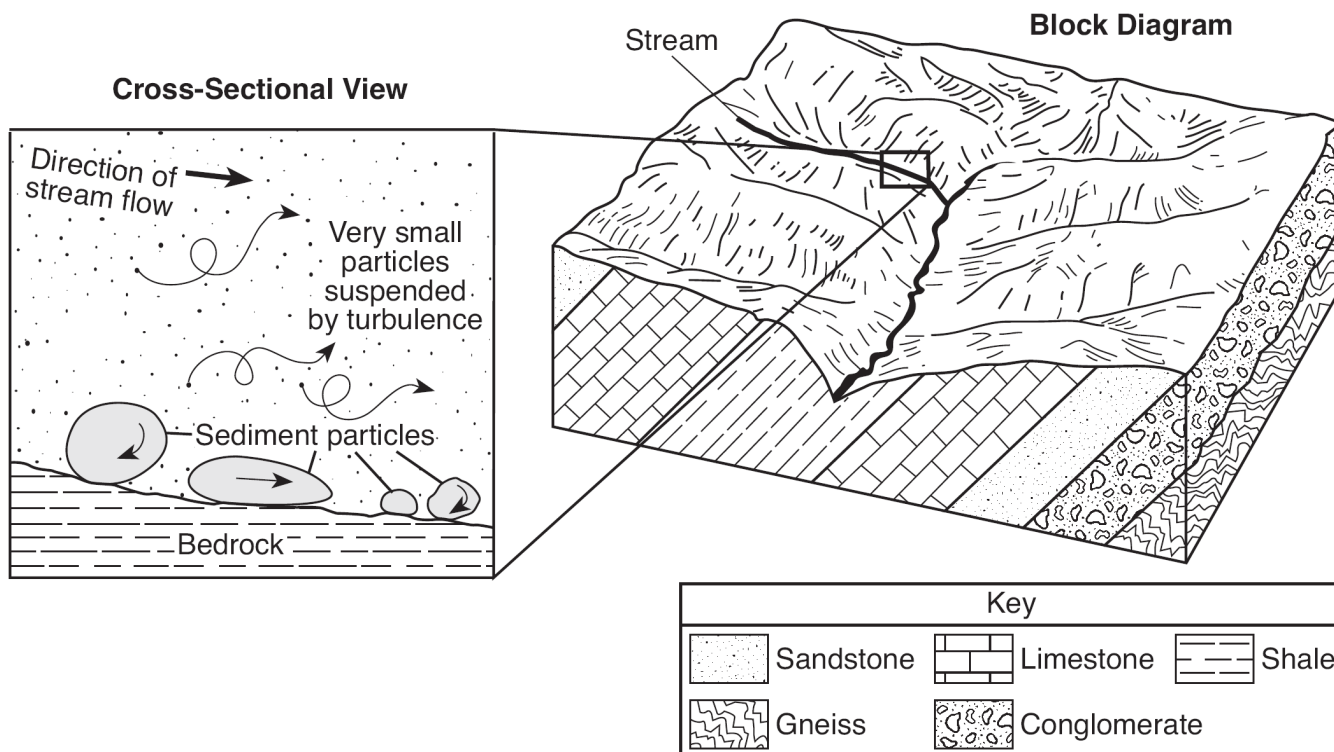
- 18 The cross section below illustrates the normal pattern of sediments deposited where a stream enters a lake. Letter *X* represents a particular type of sediment.



(Not drawn to scale)

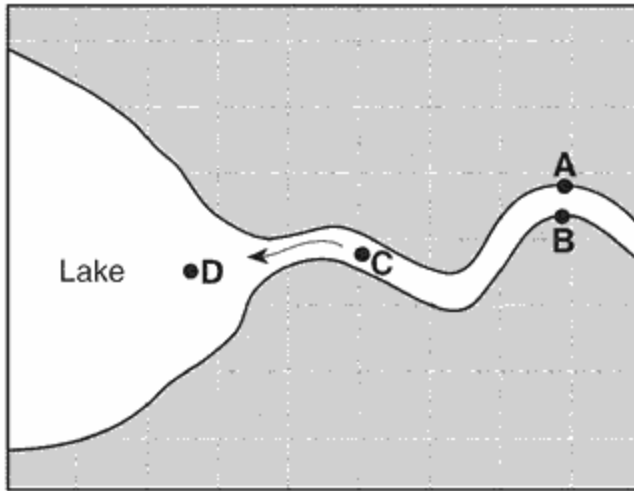
- ?** *a* Briefly explain why deposition of sediment usually occurs where a stream enters a lake.
b Name the type of sediment most likely represented by letter *X*.

- 19 Base your answer to the following question on



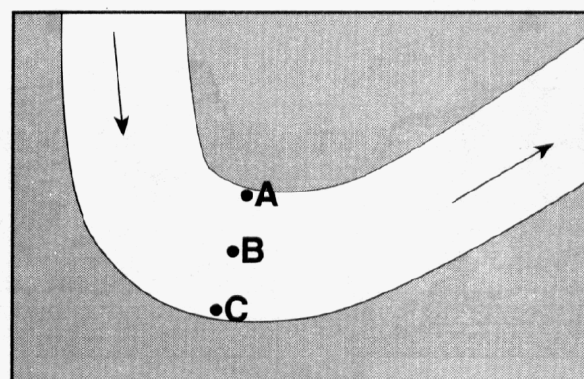
- ?** What process is responsible for producing the rounded shape of the particles shown on the stream bottom in the cross section?

- 20 the map below, which shows a meandering stream as it enters a lake. Points *A* through *D* represent locations in the stream.



- ? The stream velocity at point *C* is 100 centimeters per second and the stream velocity at point *D* is 5 centimeters per second. Identify *one* sediment particle most likely being deposited between points *C* and *D*.

- 1 The map below shows the bend of a large meandering stream. The arrows show the direction of stream flow, Letters *A*, *B*, and *C* are positions on the streambed where erosion and deposition data were collected.



Which table best represents the locations where erosion and deposition are dominant and where an equilibrium exists between the two processes? [A check mark represents the dominant process for each lettered location.]

(1)

	Erosion	Equilibrium	Deposition
A		✓	
B			✓
C	✓		

(3)

	Erosion	Equilibrium	Deposition
A	✓		
B		✓	
C			✓

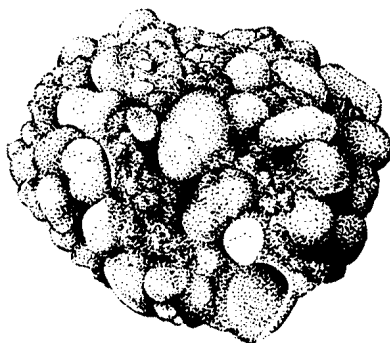
(2)

	Erosion	Equilibrium	Deposition
A			✓
B	✓		
C		✓	

(4)

	Erosion	Equilibrium	Deposition
A			✓
B		✓	
C	✓		

- 2 The diagram below shows a sedimentary rock sample.

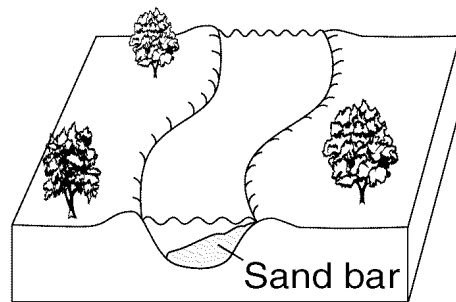


(Shown actual size)

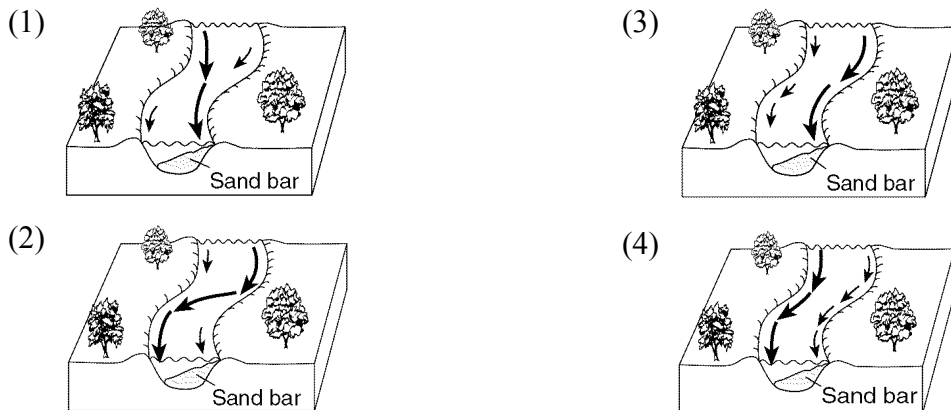
Which agent of erosion was most likely responsible for shaping the particles forming this rock?

- (1) mass movement (3) glacial ice
(2) wind (4) running water

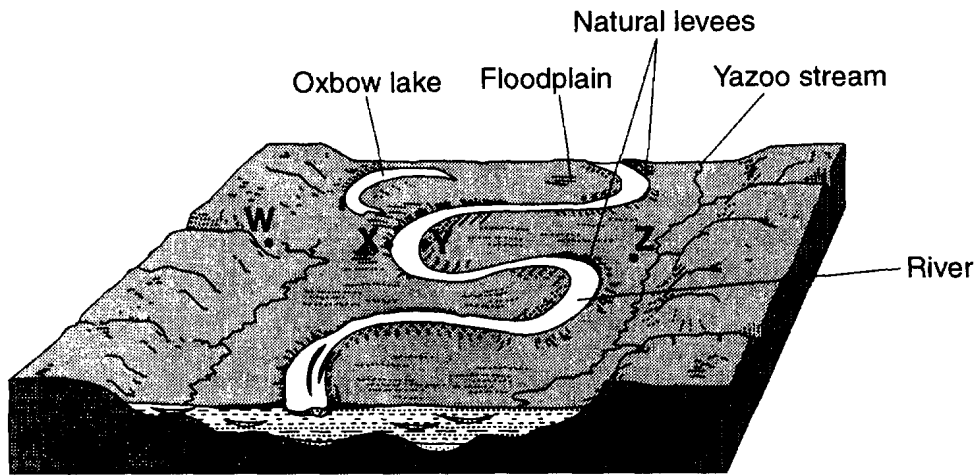
- 3 The diagram below shows a meandering stream flowing across nearly flat topography and over loose sediments.



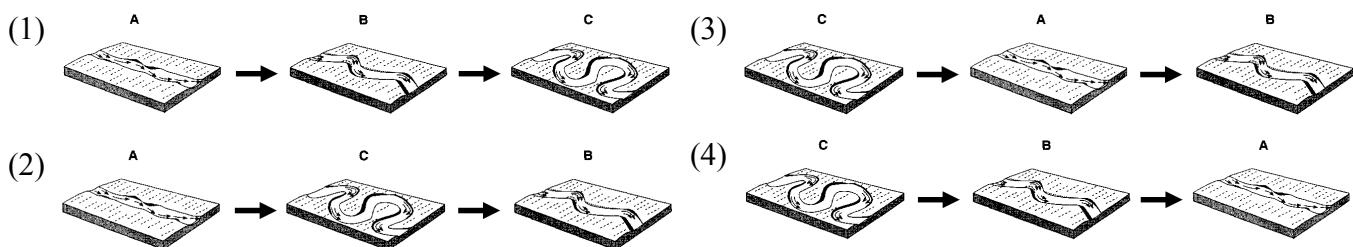
If arrow length represents stream velocity, which diagram best shows the relative stream velocities in this section of the stream?



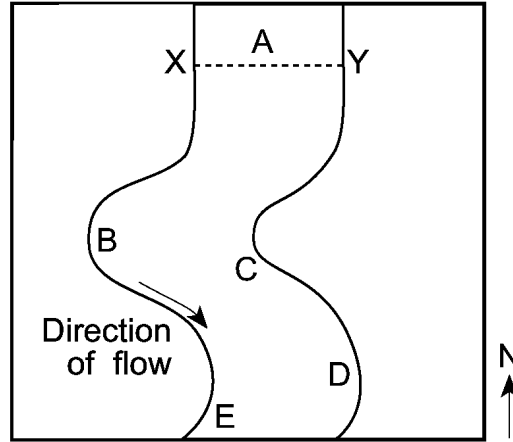
- 4 Base your answer to the following question on



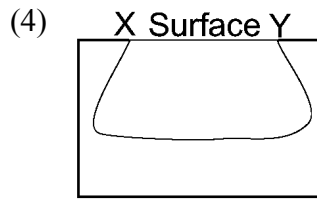
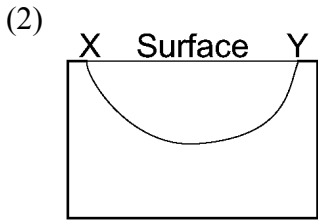
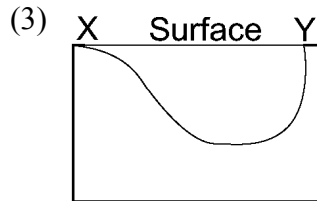
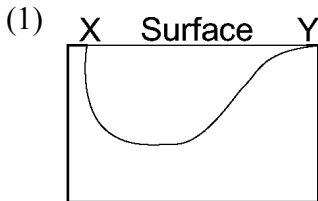
The choices below represent stages in the formation of a meandering river. Which sequence best represents the usual changes over time?



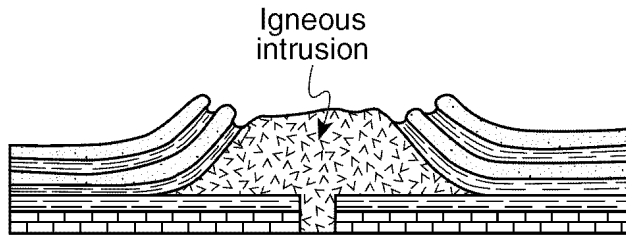
5 Base your answer to the following question on



Which cross section along line *XY* best represents the shape of the stream bottom?

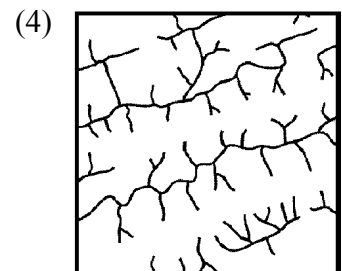
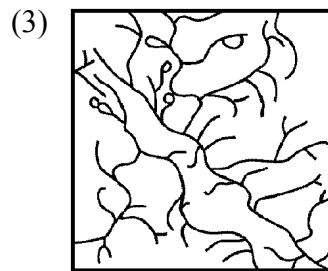
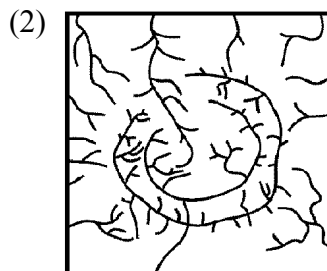
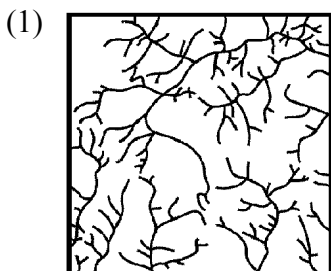


6 The cross section below shows the rock structure of a deeply eroded, domed mountain region.

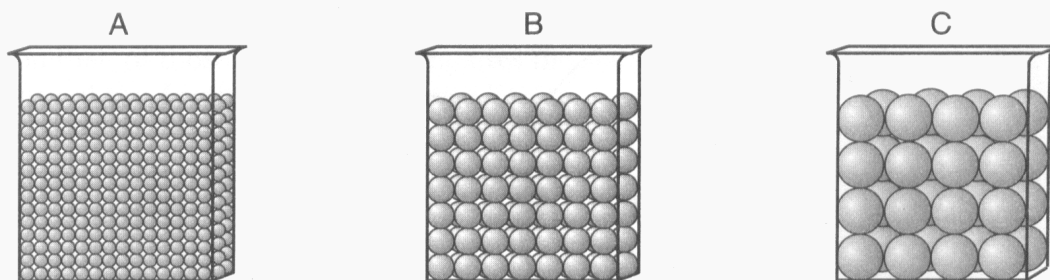


(Not drawn to scale)

Which map shows the stream drainage pattern that will most likely develop as the bedrock is weathered and eroded from this igneous dome?



- 7 The diagrams below represent three containers, *A*, *B*, and *C*, which were filled with equal volumes of uniformly sorted plastic beads. Water was poured into each container to determine porosity and infiltration time.



(Not drawn to scale)

Which data table best represents the porosity and infiltration time of the beads in the three containers?

(1)

Beaker	Porosity (%)	Infiltration Time (sec)
A	40	5.2
B	40	2.8
C	40	0.4

(3)

Beaker	Porosity (%)	Infiltration Time (sec)
A	20	5.2
B	30	2.8
C	40	0.4

(2)

Beaker	Porosity (%)	Infiltration Time (sec)
A	40	0.4
B	40	2.8
C	40	5.2

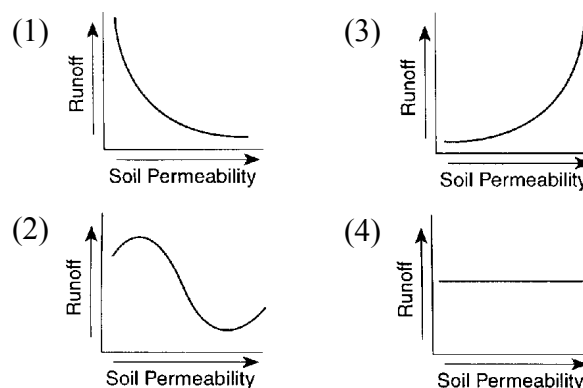
(4)

Beaker	Porosity (%)	Infiltration Time (sec)
A	20	0.4
B	30	2.8
C	40	5.2

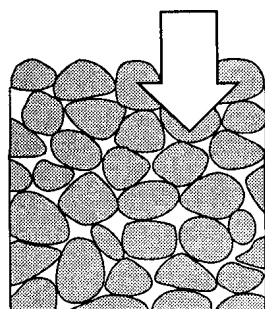
- 8 Which set of surface soil conditions on a hillside would result in the most infiltration of rainfall?

- (1) gentle slope, saturated soil, no vegetation
- (2) gentle slope, unsaturated soil, vegetation
- (3) steep slope, saturated soil, vegetation
- (4) steep slope, unsaturated soil, no vegetation

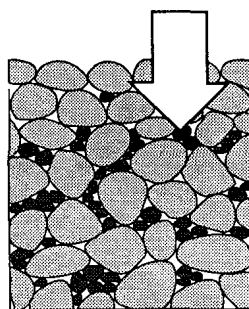
- 9 Which graph shows the effect of soil permeability on the amount of runoff in an area?



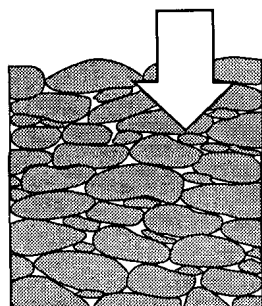
10 Base your answer to the following question on



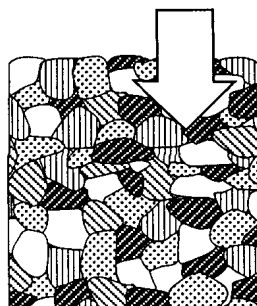
Pebble soil



Pebble-and-sand soil



Conglomerate
bedrock



Granite bedrock

The pebble-and-sand soil has greater capillarity than the pebble soil because the pebble and sand soil

- | | |
|--------------------------------|-----------------------------|
| (1) is weathering more rapidly | (3) has smaller pore spaces |
| (2) is more loosely packed | (4) has less surface area |

11 The generalized landscape regions of New York State are classified according to

- (1) bedrock structure and elevation
- (2) bedrock type and index fossils
- (3) latitude and longitude
- (4) climate and topography

12 Which New York State landscape feature was formed primarily as a result of glacial deposition?

- (1) Adirondack Mountains
- (2) Hudson-Mohawk Lowlands
- (3) Tug Hill Plateau
- (4) Long Island

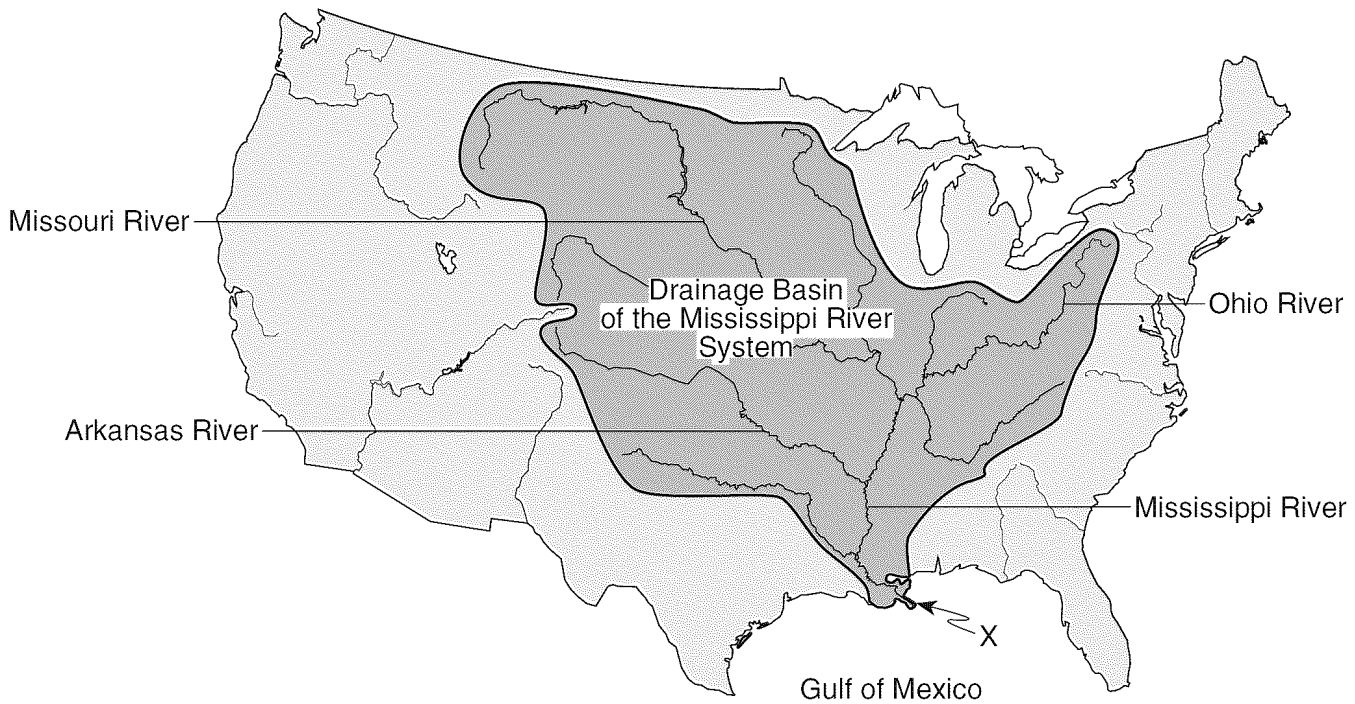
13 The occurrence of parallel scratches on bedrock in a U-shaped valley indicates that the area has most likely been eroded by

- | | |
|---------------|-----------|
| (1) a glacier | (3) waves |
| (2) a stream | (4) wind |

14 The Canaries Current along the west coast of Africa and the Peru Current along the west coast of South America are both

- (1) warm currents that flow away from the Equator
- (2) warm currents that flow toward the Equator
- (3) cool currents that flow away from the Equator
- (4) cool currents that flow toward the Equator

Base your answer to questions **15** and **16** on the map below, which shows the drainage basin of the Mississippi River system. Several rivers that flow into the Mississippi River are labeled. The arrow at location *X* shows where the Mississippi River enters the Gulf of Mexico.



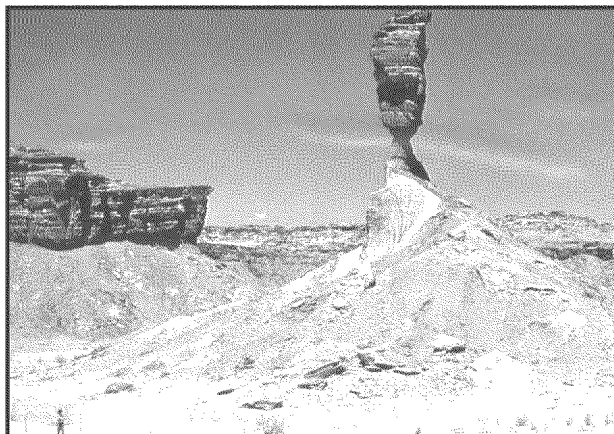
15 The entire land area drained by the Mississippi River system is referred to as a

- (1) levee (2) watershed (3) meander belt (4) floodplain

16 The structure formed by the deposition of sediments at location *X* is best described as a

- (1) moraine (2) tributary (3) delta (4) drumlin

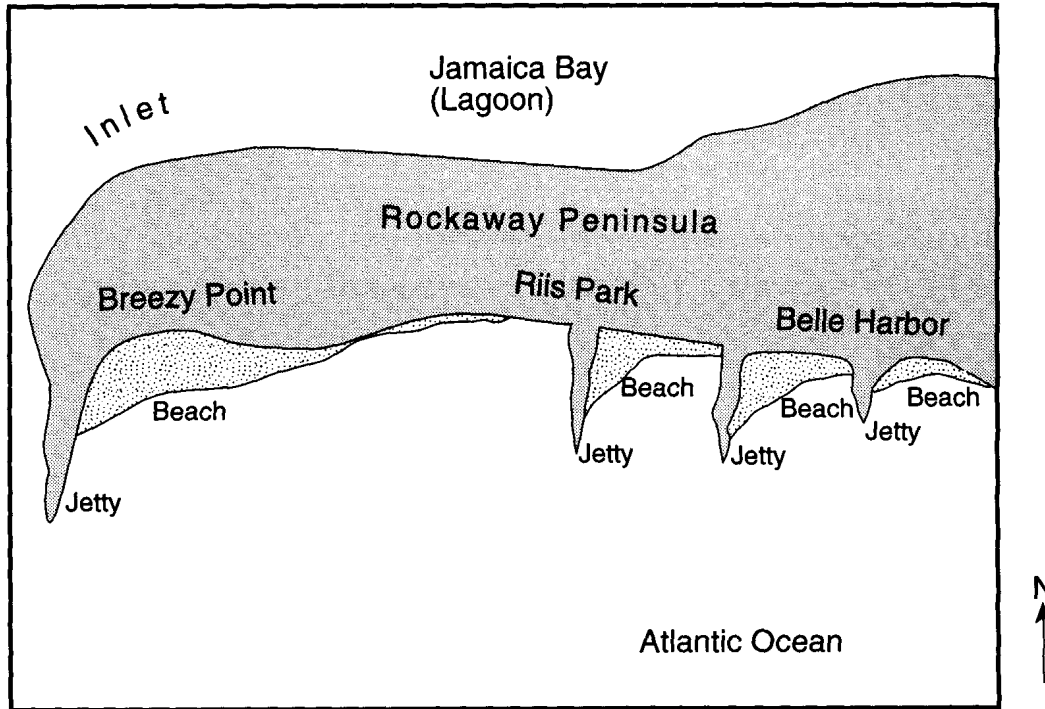
17 The picture below shows a geological feature in the Kalahari Desert of southwestern Africa.



Which process most likely produced the present appearance of this feature?

- (1) wind erosion (3) earthquake vibrations
(2) volcanic eruption (4) plate tectonics

18 Base your answer to the following question on

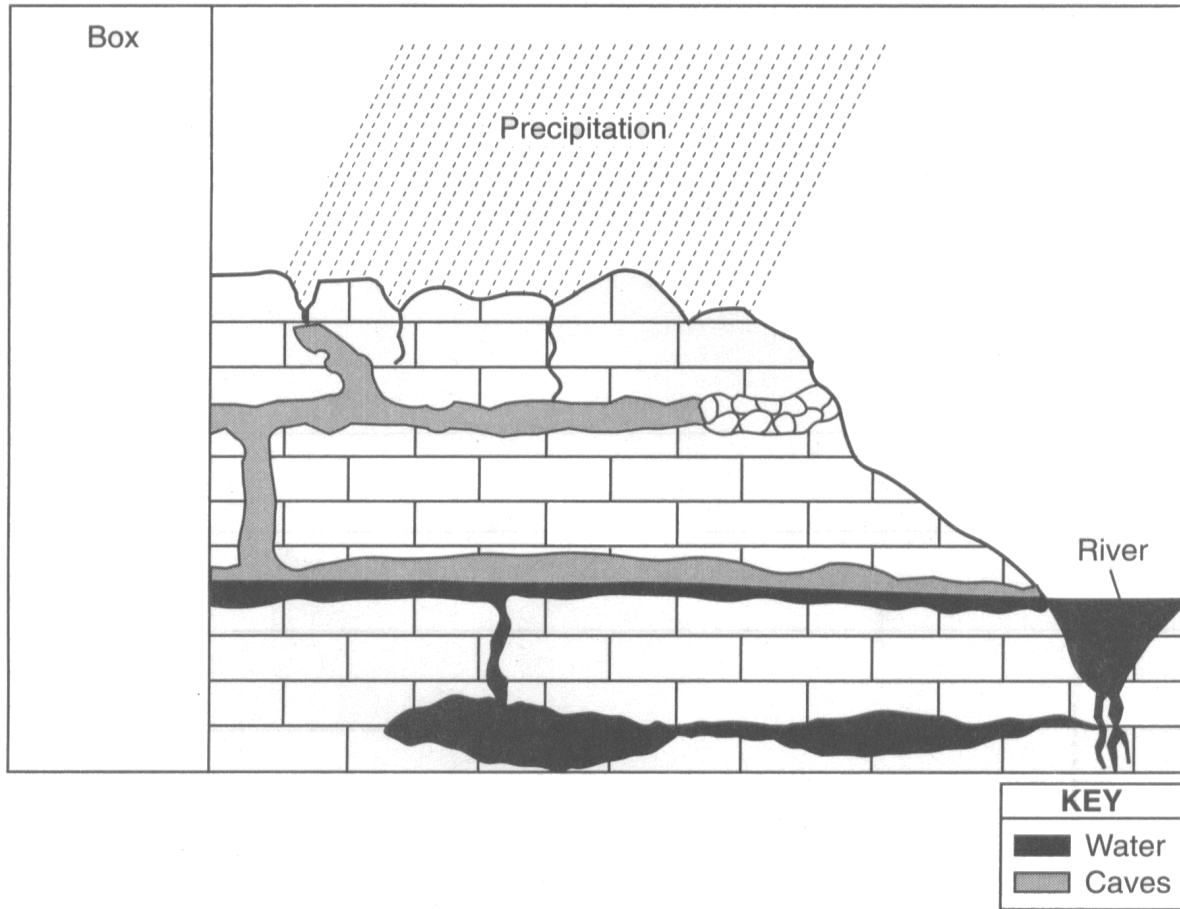


Toward which direction is sand being transported along the shoreline within the zone of breaking waves?

- (1) northeast (2) south (3) southeast (4) west

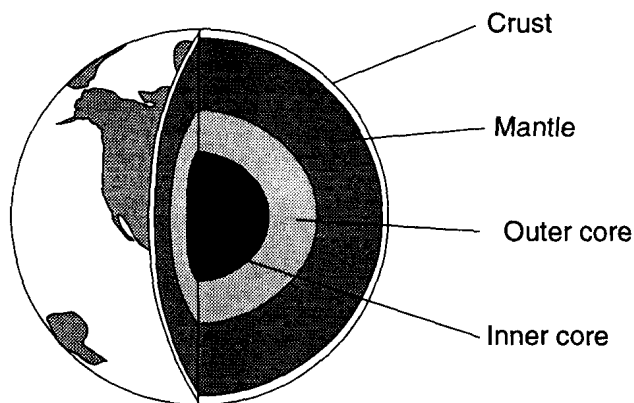
? 19 Part of which generalized New York State landscape region is drained by the Susquehanna River and its tributaries?

20 Base your answer to the following question on



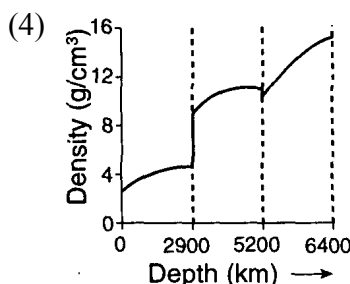
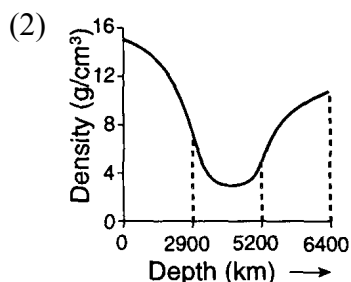
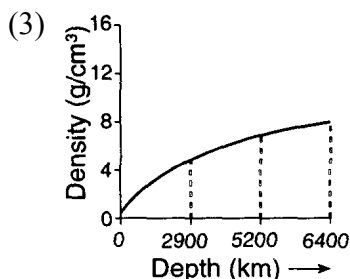
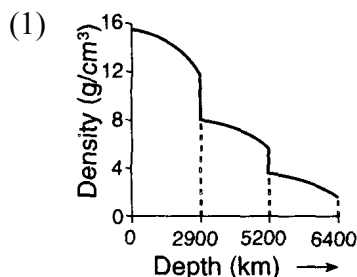
The precipitation in this area is becoming more acidic. Explain why acid rain weathers limestone bedrock.

Base your answer to questions 1 and 2 on the diagram below which represents Earth's interior zones.



(Not drawn to scale)

1 Which graph best represents the relationship between depth below Earth's surface and density?



2 Scientists have classified Earth's interior into the zones shown based primarily on evidence gained by studying

(1) deep drill cores

(3) gravity measurements

(2) volcanic eruptions

(4) earthquake seismic waves

3 The rock between 2,900 kilometers and 5,200 kilometers below the Earth's surface is inferred to be

(1) an iron-rich solid

(3) a silicate-rich solid

(2) an iron-rich liquid

(4) a silicate-rich liquid

4 The basaltic bedrock of the oceanic crust is classified as

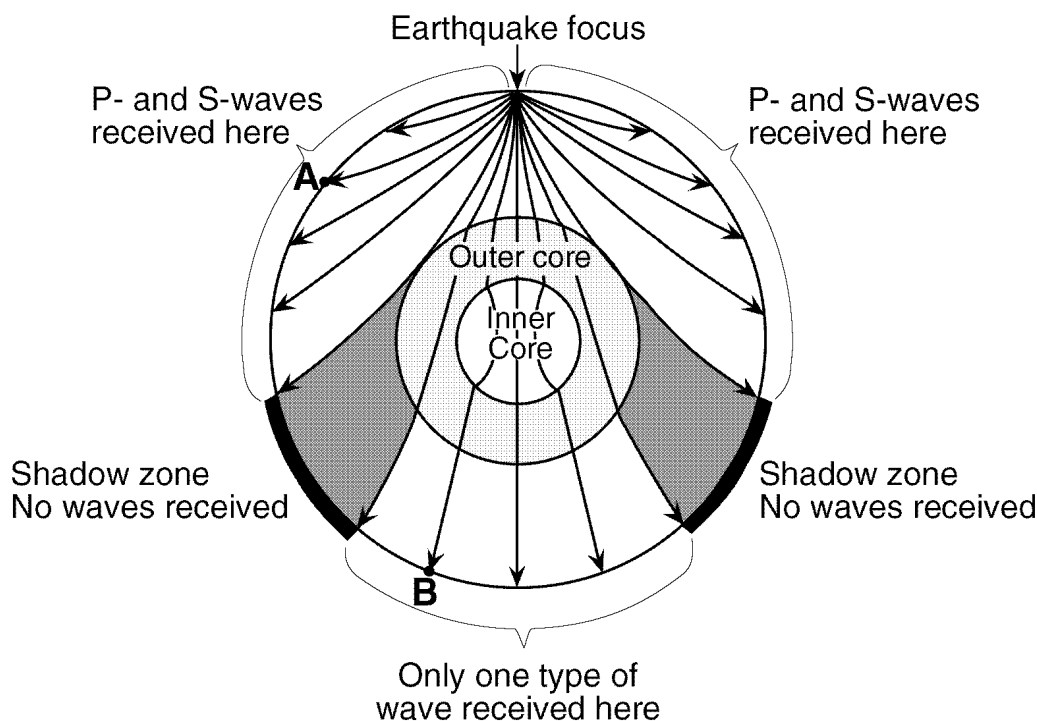
(1) felsic, with a density of 2.7 g/cm³

(2) felsic, with a density of 3.0 g/cm³

(3) mafic, with a density of 2.7 g/cm³

(4) mafic, with a density of 3.0 g/cm³

5 Base your answer to the following question on



Which statement best explains why only one type of seismic wave was recorded at location *B*?

- (1) *S*-waves cannot travel through the liquid outer core.
- (2) *S*-waves cannot travel through the liquid inner core.
- (3) *P*-waves cannot travel through the solid outer core.
- (4) *P*-waves cannot travel through the solid inner core.

6 A huge undersea earthquake off the Alaskan coastline could produce a

- (1) tsunami
- (2) cyclone
- (3) hurricane
- (4) thunderstorm

7 An earthquake's first *P*-wave arrives at a seismic station at 12:00:00. This *P*-wave has traveled 6000 kilometers from the epicenter. At what time will the first *S*-wave from the same earthquake arrive at the seismic station?

- (1) 11:52:20
- (2) 12:07:40
- (3) 12:09:20
- (4) 12:17:00

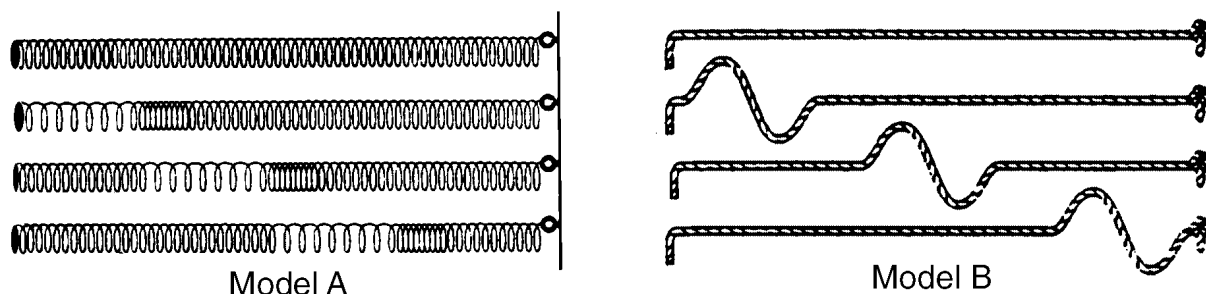
8 If a seismograph recording station located 5,700 kilometers from an epicenter receives a *P*-wave at 4:45 P.M., at which time did the earthquake actually occur at the epicenter?

- (1) 4:24 P.M.
- (2) 4:29 P.M.
- (3) 4:36 P.M.
- (4) 4:56 P.M.

9 According to tectonic plate maps, New York State is presently located

- (1) at a convergent plate boundary
- (2) above a mantle hot spot
- (3) above a mid-ocean ridge
- (4) near the center of a large plate

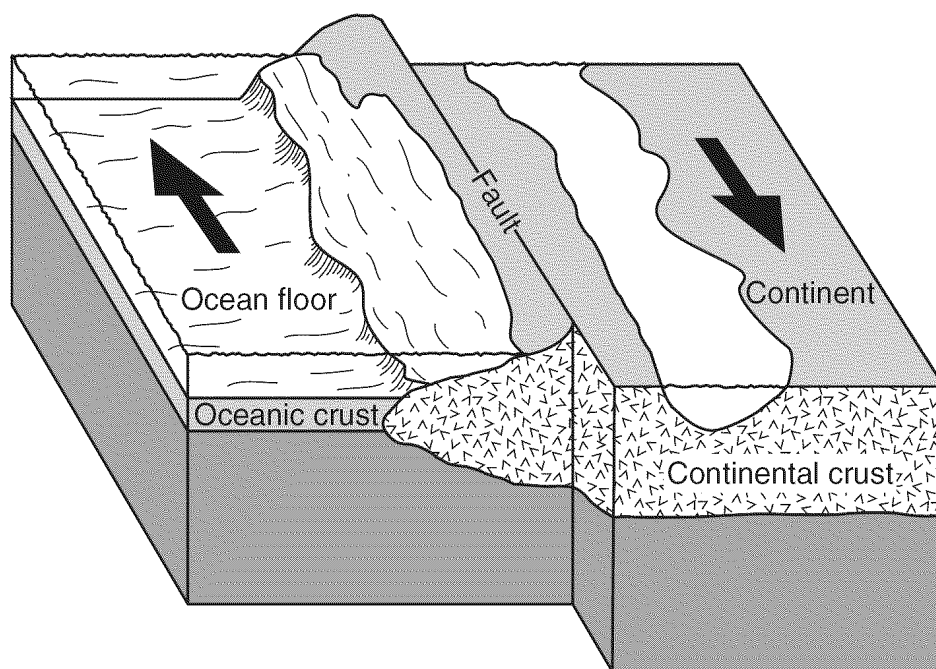
10 Base your answer to the following question on



Model A best represents the motion of earthquake waves called

- (1) *P*-waves (compressional waves) that travel faster than *S*-waves (shear waves) shown in model B
- (2) *P*-waves (compressional waves) that travel slower than *S*-waves (shear waves) shown in model B
- (3) *S*-waves (shear waves) that travel faster than *P*-waves (compressional waves) shown in model B
- (4) *S*-waves (shear waves) that travel slower than *P*-waves (compressional waves) shown in model B

11 Arrows in the block diagram below show the relative movement along a tectonic plate boundary.

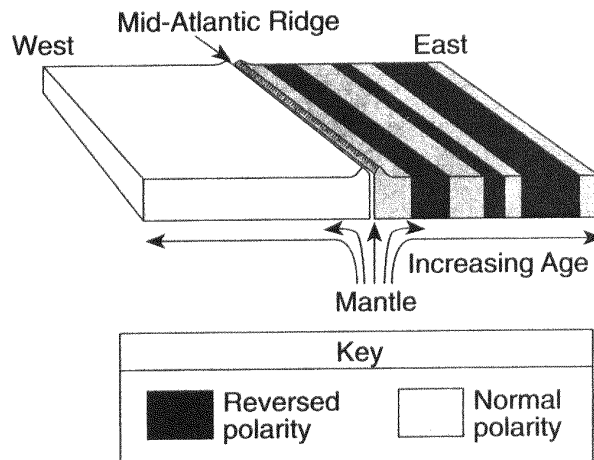


(Not drawn to scale)

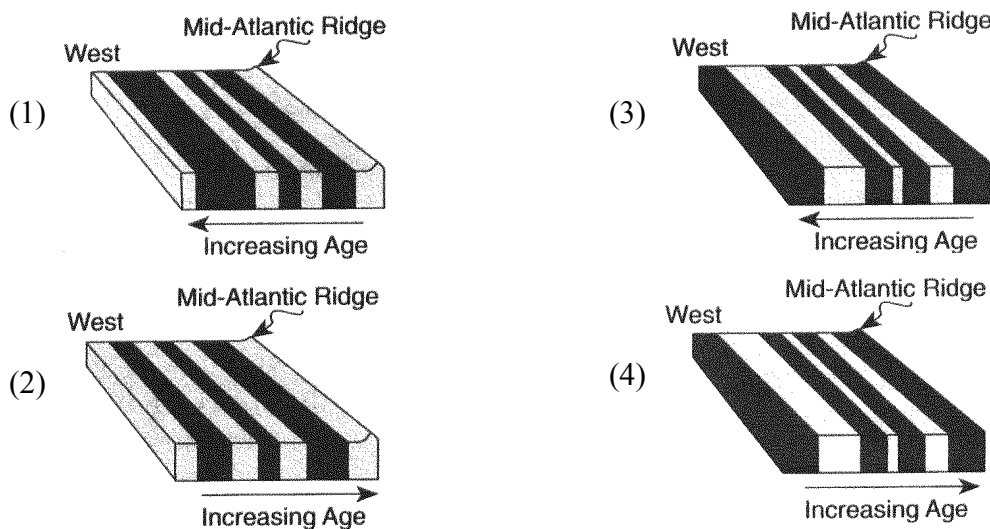
Between which two tectonic plates does this type of plate boundary exist?

- (1) Nazca Plate and South American Plate
- (2) Eurasian Plate and Indian-Australian Plate
- (3) North American Plate and Eurasian Plate
- (4) Pacific Plate and North American Plate

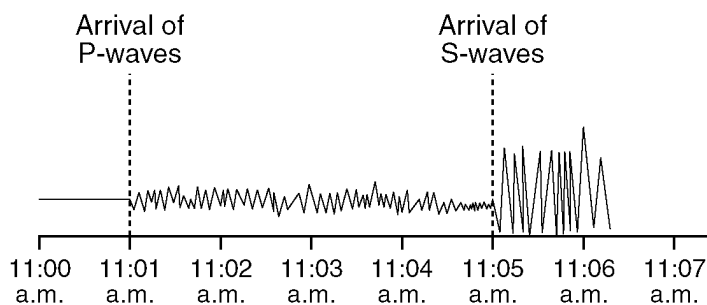
- 12 The diagram below represents the pattern of normal and reversed magnetic polarity and the relative age of the igneous bedrock composing the ocean floor on the east side of the Mid-Atlantic Ridge. The magnetic polarity of the bedrock on the west side of the ridge has been deliberately left blank.



Which diagram best shows the magnetic pattern and relative age of the igneous bedrock on the west side of the ridge?



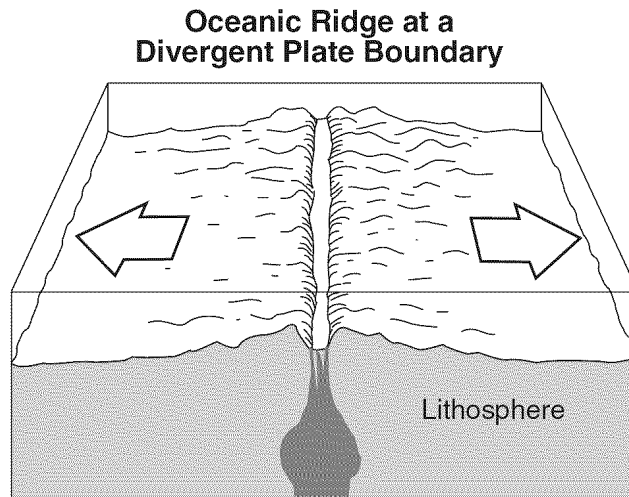
- 13 Base your answer to the following question on



When did the first P-waves arrive at this seismic station?

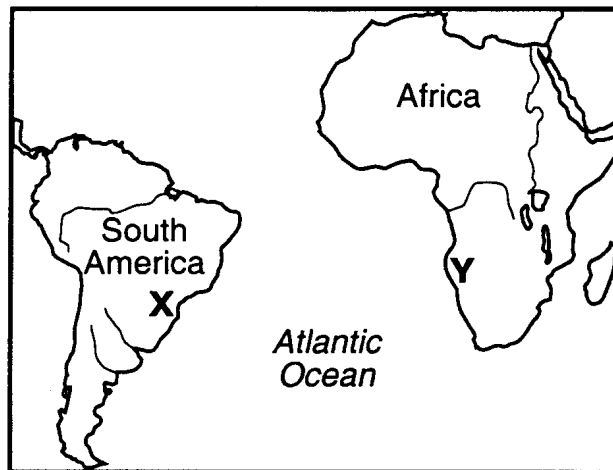
- (1) 3 minutes after an earthquake occurred 2,600 km away
- (2) 5 minutes after an earthquake occurred 2,600 km away
- (3) 9 minutes after an earthquake occurred 3,500 km away
- (4) 11 minutes after an earthquake occurred 3,500 km away

14 The diagram below shows a tectonic plate boundary.



Which mantle hot spot is at a plate boundary like the one shown in this diagram?

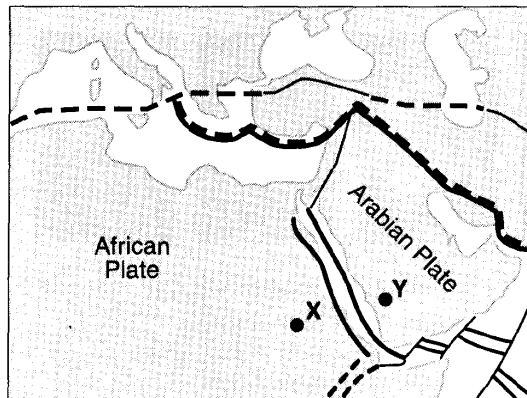
- | | |
|--------------------------|------------------------|
| (1) Hawaii Hot Spot | (3) Galapagos Hot Spot |
| (2) Yellowstone Hot Spot | (4) Canary Hot Spot |
- 15 The map below shows the present-day locations of South America and Africa. Remains of *Mesosaurus*, an extinct freshwater reptile, have been found in similarly aged bedrock formed from lake sediments at locations *X* and *Y*.



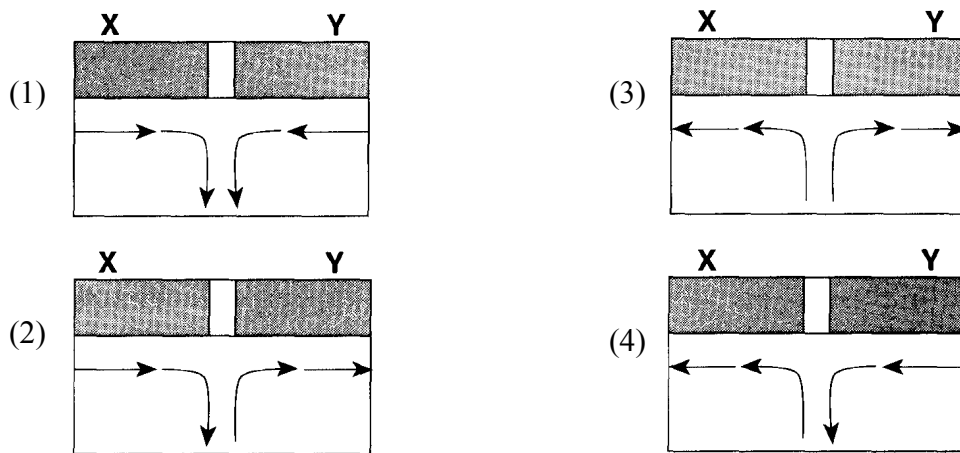
Which statement represents the most logical conclusion to draw from this evidence?

- (1) *Mesosaurus* migrated across the ocean from location *X* to location *Y*.
- (2) *Mesosaurus* came into existence on several widely separated continents at different times.
- (3) The continents of South America and Africa were joined when *Mesosaurus* lived.
- (4) The present climates at locations *X* and *Y* are similar.

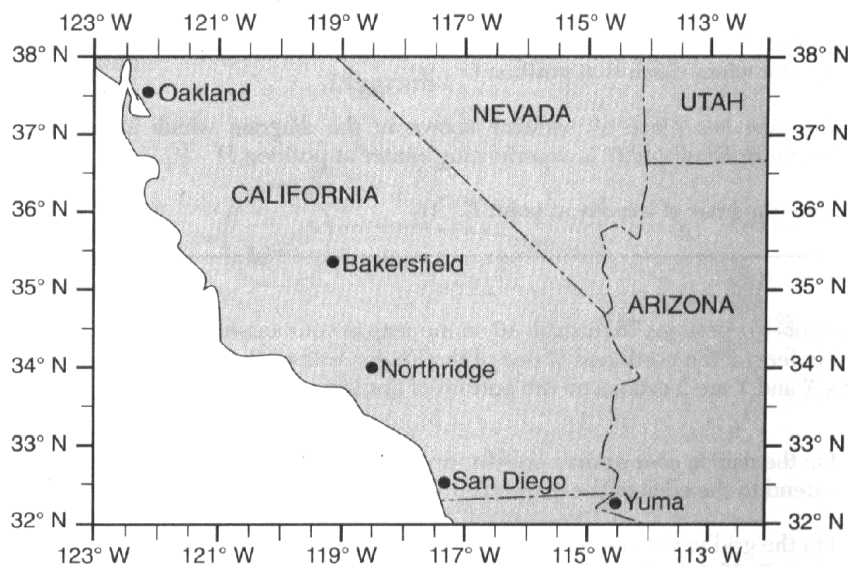
16 The map below shows a portion of Earth's surface. Points *X* and *Y* are locations on the lithosphere.



Which cross section shows the inferred movement of material in the asthenosphere beneath points *X* and *Y*?

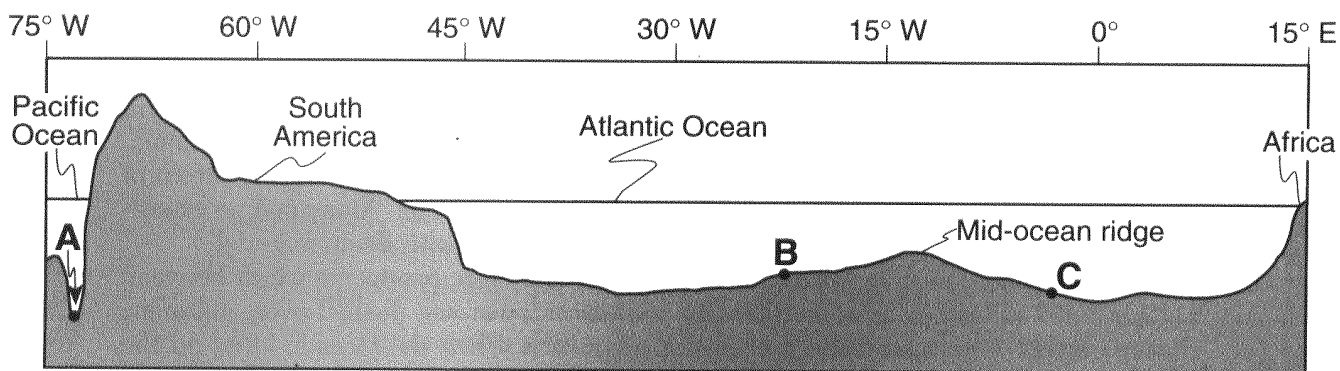


Base your answer to questions 17 and 18 on the map below, which shows a portion of southwestern United States. On January 17, 1994, an earthquake occurred with an epicenter of Northridge, California.



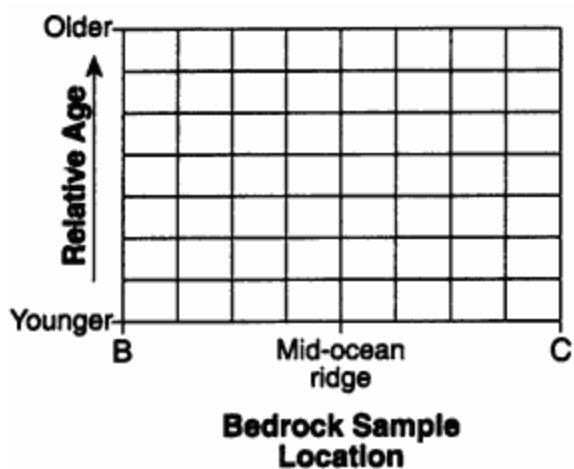
- 17 List *two* actions that a homeowner could take to prepare the home ro family for the next earthquake.
- 18 Explain why earthquakes are common in this region of California.

19 Base your answer to the following question on

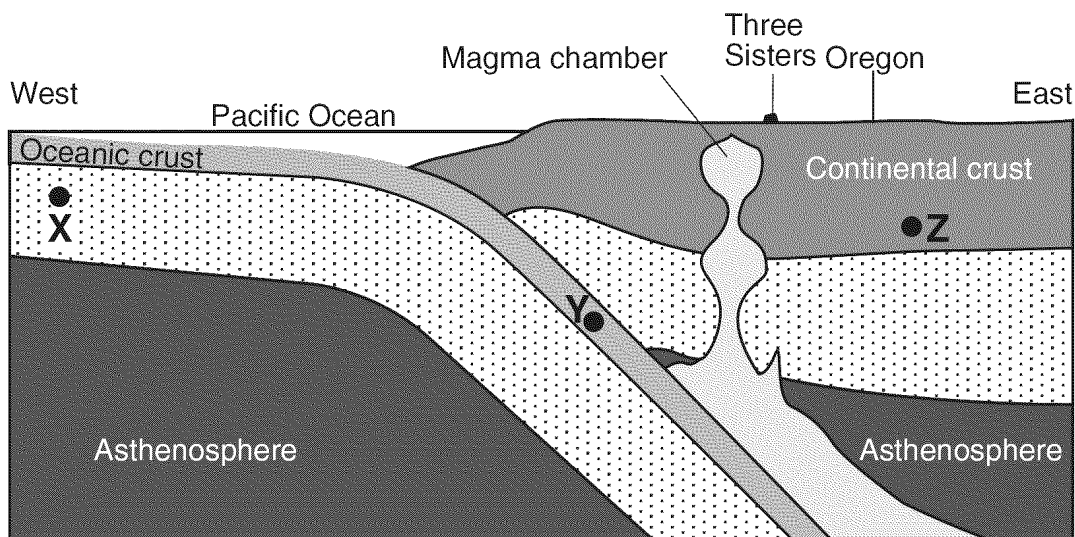


(Not drawn to scale)

Bedrock samples were taken at the mid-ocean ridge and points B and C. On the grid, draw a line to show the relative age of the bedrock samples between these locations.



20 Base your answer to the following question on

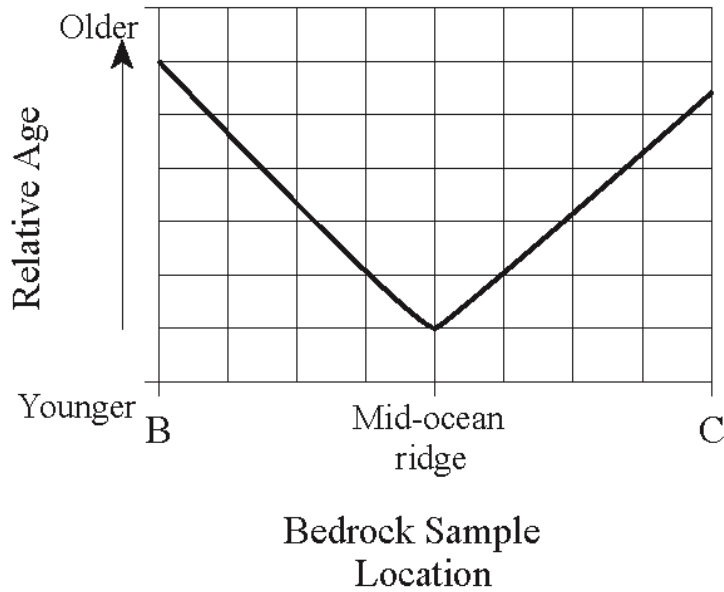


(Not drawn to scale)

On the same cross section, place arrows through each point, X, Y, and Z, to indicate the relative motion of *each* of these sections of the lithosphere.

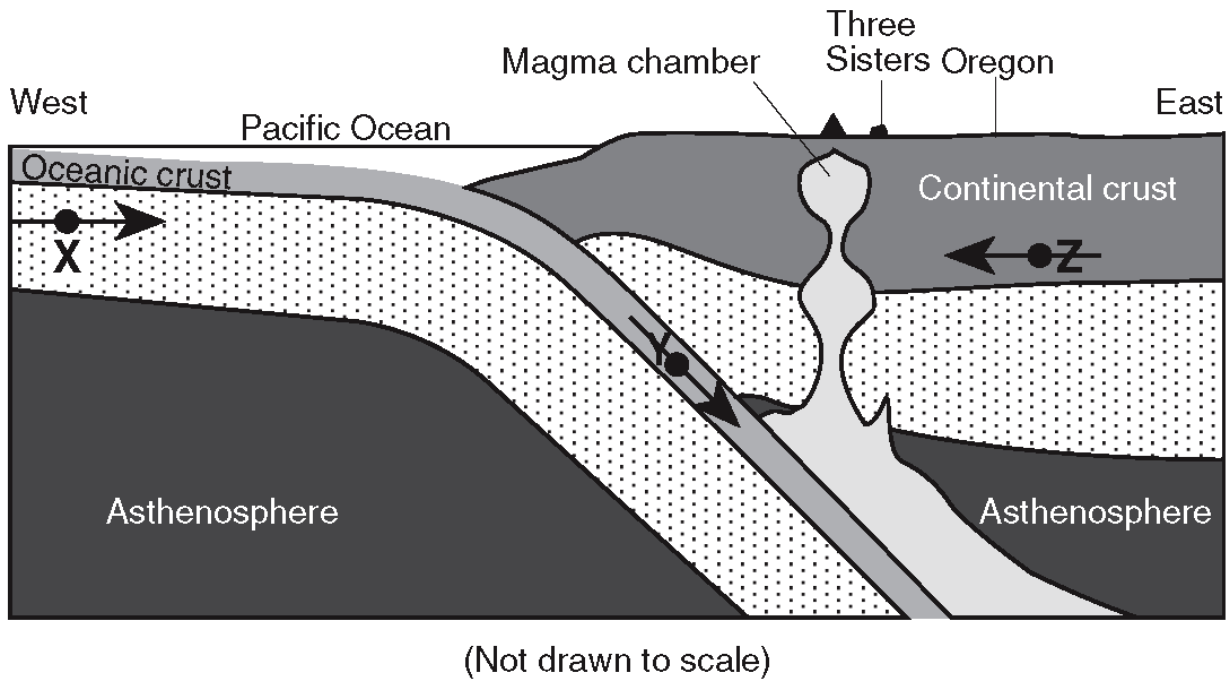
- 19 [1]** Allow 1 credit for a correctly drawn line. The line may be curved or straight, and the lowest point should be at the mid-ocean ridge.

Example of a 1-credit response:

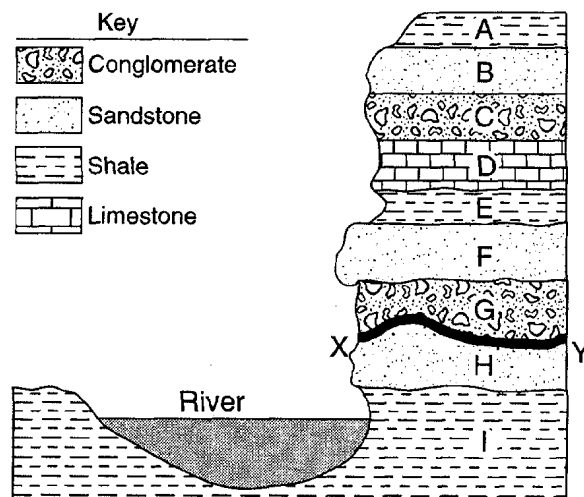


20 [1] Allow 1 credit if all *three* arrows show the correct directions, even if the arrows do *not* pass through the dots.

Example of a correct response for question 20:

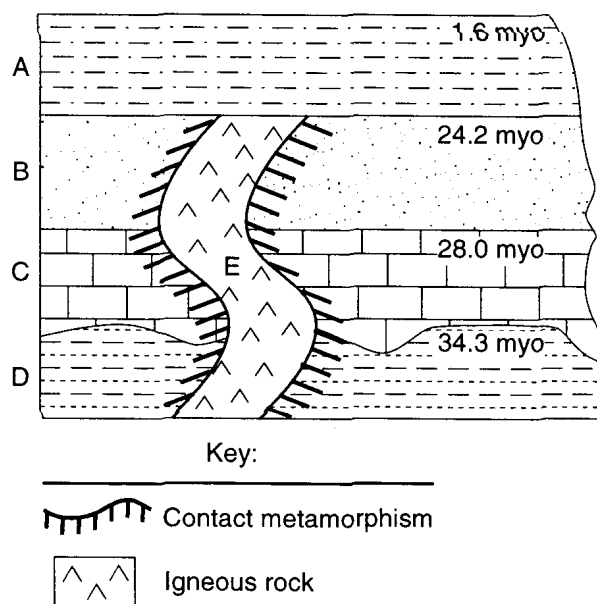


- 1 Base your answer to the following question on the diagram below, which is a geologic cross section of an area where a river has exposed a 300-meter cliff of sedimentary rock layers. The rock layers are labeled *A* through *I*. Line *XY* represents a gap in the geologic record (an unconformity).



Which layer is oldest? [Assume that the rock layers have not been overturned.]

- (1) *A* (2) *B* (3) *H* (4) *I*
- 2 The geologic cross section below represents a cliff outcrop. Some bedrock layers are labeled as millions of years old (myo). Letters *A* through *E* represent different rock types.

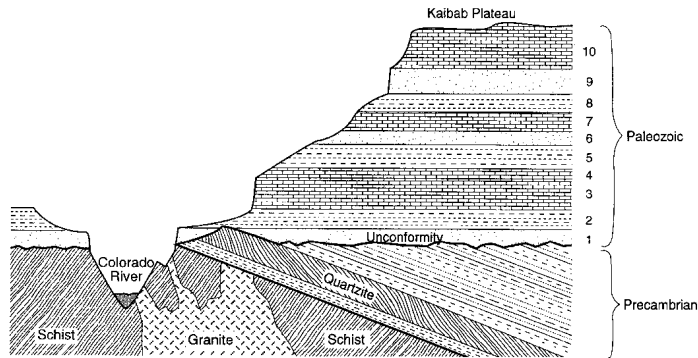


What is a possible age of igneous rock *E*?

- (1) 1.5 million years old (3) 28 million years old
(2) 12 million years old (4) 40 million years old
- 3 Uranium-238 that crystallized at the same time Earth formed has undergone approximately how many half-lives of radioactive decay?

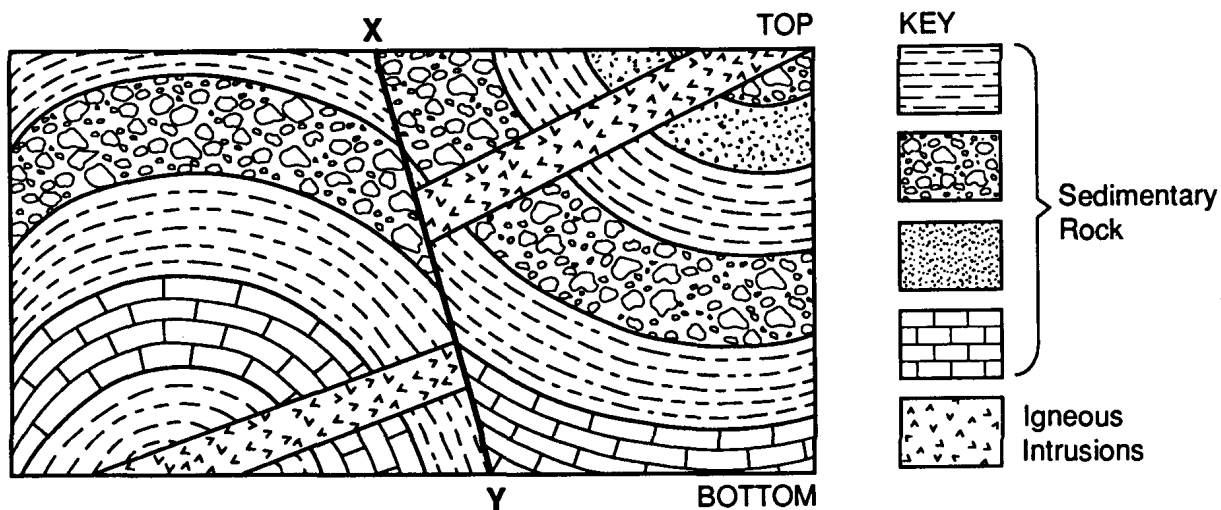
- (1) one half-life (3) three half-lives
(2) two half-lives (4) four half-lives

- 4 Base your answer to the following question on the geologic cross section below of the Grand Canyon. The numbers 1 through 10 represent Paleozoic sedimentary rock layers.



The unconformity between the Paleozoic sedimentary rocks and the Precambrian sedimentary rocks represents

- (1) a gap in the geologic time record (3) an abundance of fossils
(2) an intrusion of igneous rock (4) a region of metamorphic rock
- 5 The diagram below shows a cross section of the Earth's crust. Line *XY* is a fault.



Which sequence of events, from oldest to youngest, has occurred in this outcrop?

- (1) formation of sedimentary layers → igneous intrusion → folding of layers → faulting (3) igneous intrusion → faulting → formation of sedimentary layers → folding of layers
(2) igneous intrusion → formation of sedimentary layers → folding of layers → faulting (4) formation of sedimentary layers → folding of layers → igneous intrusion → faulting

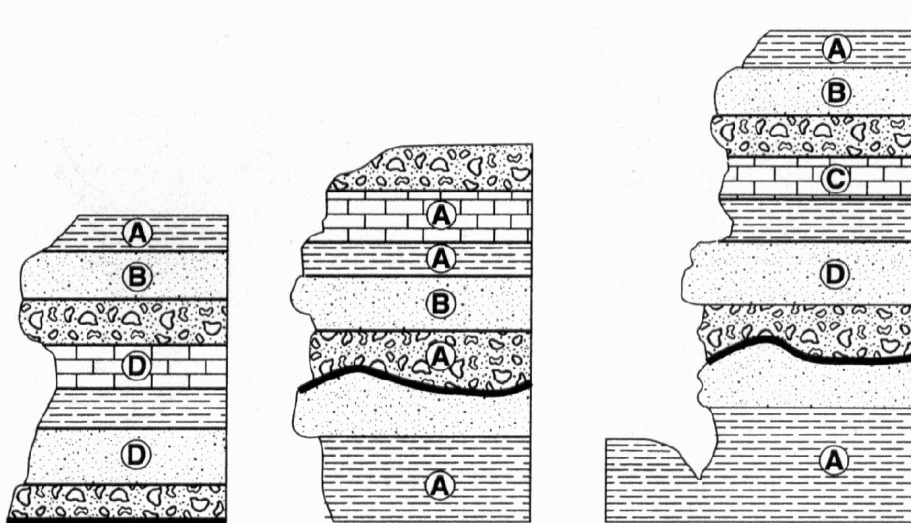
- 6 Which two landscape regions in New York State have the oldest surface bedrock?

- (1) Allegheny Plateau and Newark Lowlands
(2) Tug Hill Plateau and Erie-Ontario Lowlands
(3) Taconic Mountains and the Catskills
(4) Adirondack Mountains and Hudson Highlands

- 7 A sample of wood that originally contained 100 grams of carbon-14 now contains only 25 grams of carbon-14. Approximately how many years ago was this sample part of a living tree?

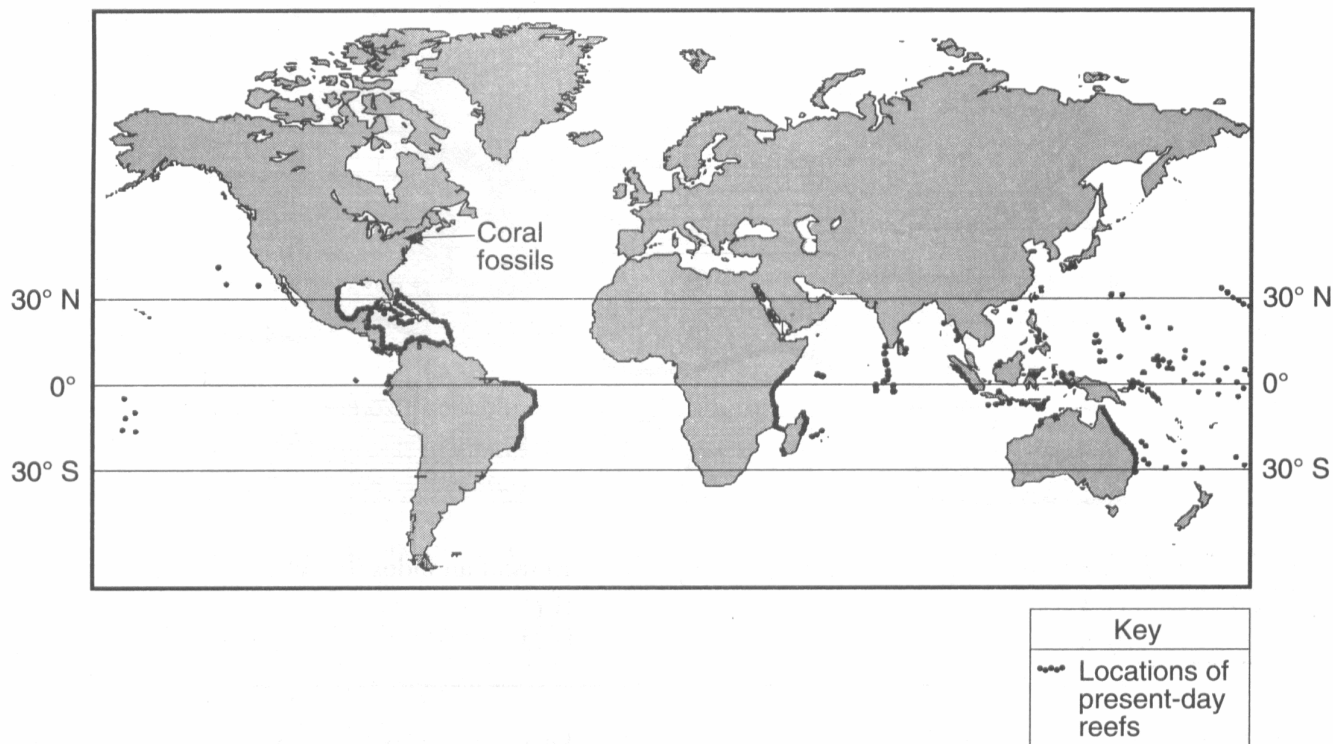
- (1) 2,850 years (3) 11,400 years
(2) 5,700 years (4) 17,100 years

- 8 The cross sections below represent three widely separated outcrops of exposed bedrock. Letters *A*, *B*, *C* and *D* represent fossils found in the rock layers.



Which fossil appears to have the best characteristics of an index fossil?

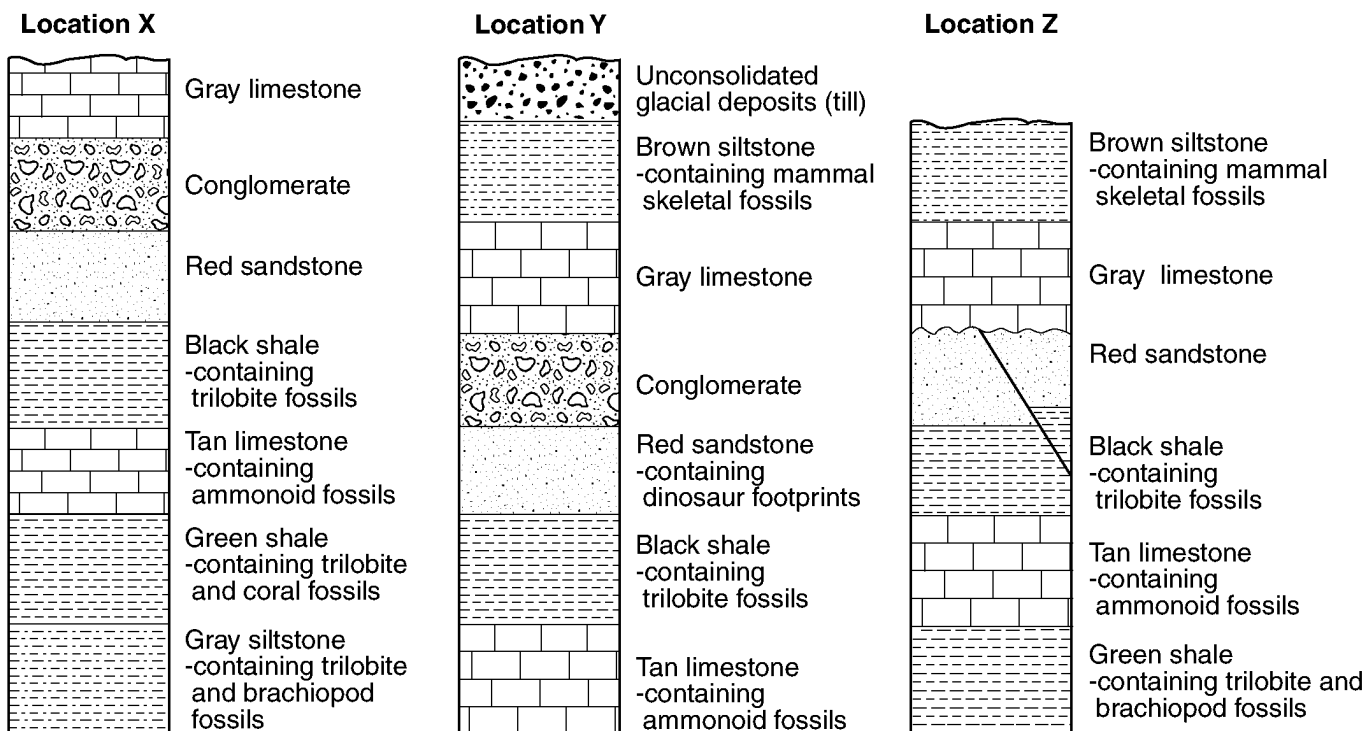
- (1) *A* (2) *B* (3) *C* (4) *D*
- 9 On the map below, the darkened areas represent locations where living corals currently exist. The arrow location where coral fossils have been found in Devonian-age bedrock in New York State.



Devonian-age coral fossils found in some New York State bedrock are *not* located in the same general region that present-day corals are living because during the Devonian Period

- (1) corals migrated to New York State (3) New York State was closer to the equator
(2) corals lived everywhere on Earth (4) New York State had a colder climate









10 Base your answer to the following question on the cross sections below, which show widely separated outcrops at locations X, Y, and Z.



An unconformity can be observed at location Z. Which rock layer was most probably removed by erosion during the time represented by the unconformity?

- (1) conglomerate (2) gray siltstone (3) black shale (4) brown siltstone

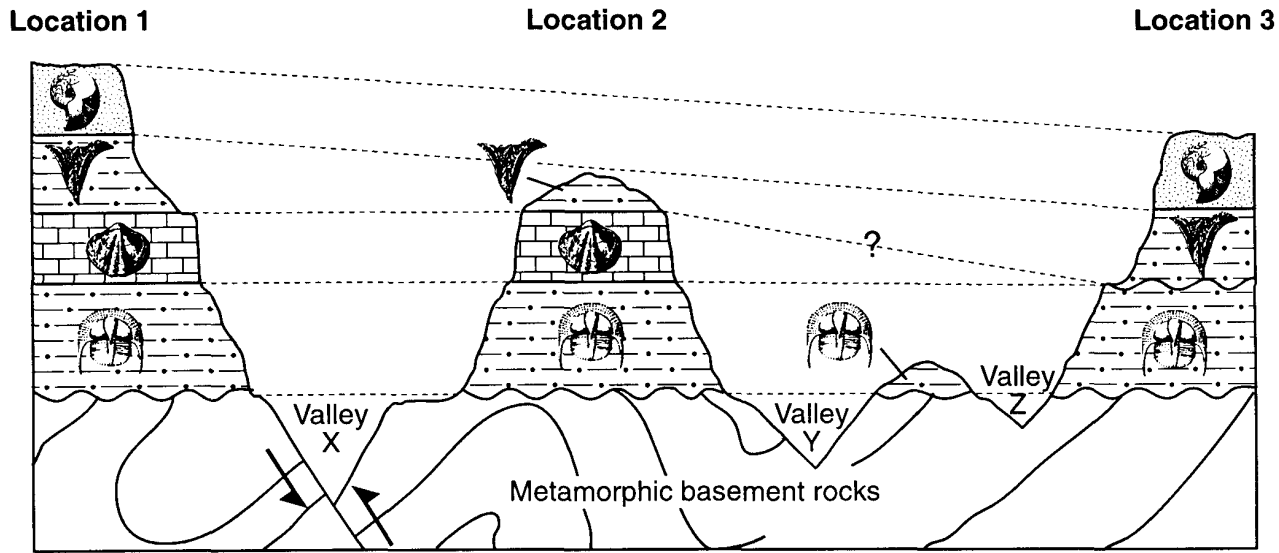
11 Which pair of index fossils can be found in Ordovician bedrock?

- (1)  and 
- (2)  and 
- (3)  and 
- (4)  and 

12 According to the fossil record, which sequence correctly represents the evolution of life on Earth?

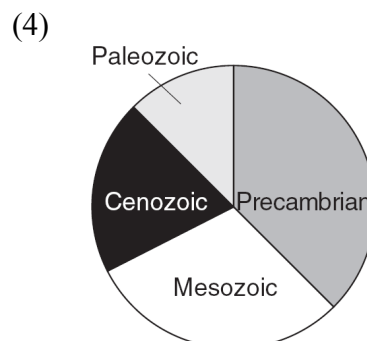
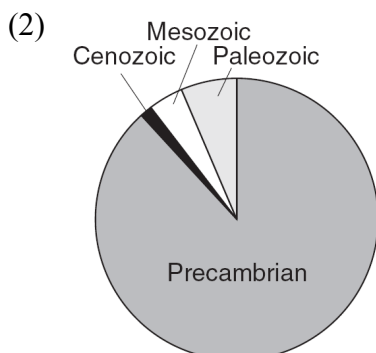
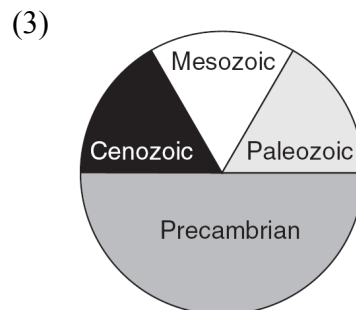
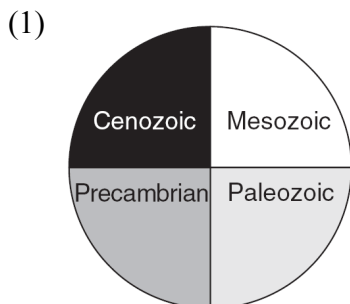
- (1) fish → amphibians → mammals → soft-bodied organisms
- (2) fish → soft-bodied organisms → mammals → amphibians
- (3) soft-bodied organisms → amphibians → fish → mammals
- (4) soft-bodied organisms → fish → amphibians → mammals

- 13 Base your answer to the following question on the geologic cross section below, which shows a view of rock layers at Earth's surface. The dashed lines connect points of the same age. Major fossils contained within each rock layer are shown. The valleys are labeled X, Y, and Z.



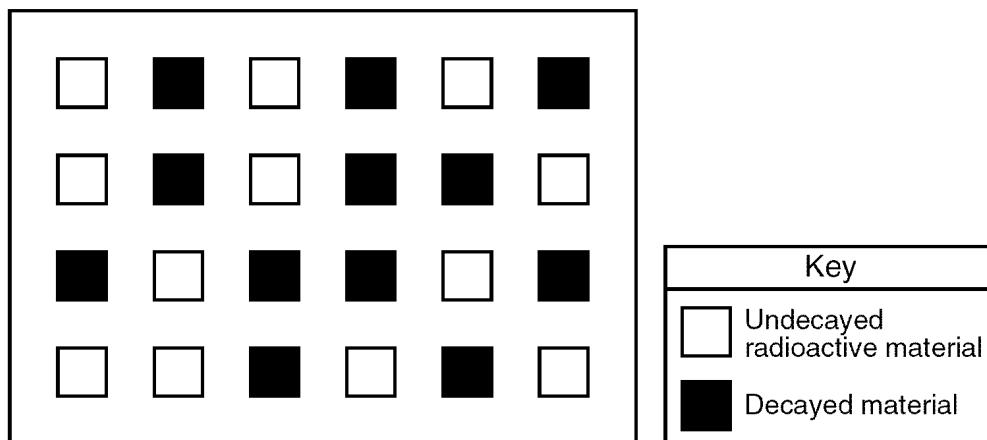
The sedimentary rock layers at the three locations can be most accurately correlated by comparing the

- (1) thickness of the sedimentary rock layers
 - (2) foliation bands in the metamorphic basement rocks
 - (3) fossils in the sedimentary rocks
 - (4) minerals in the igneous rocks
- 14 Which graph shows the relative duration of geologic time for the Precambrian, Paleozoic, Mesozoic, and Cenozoic time intervals?



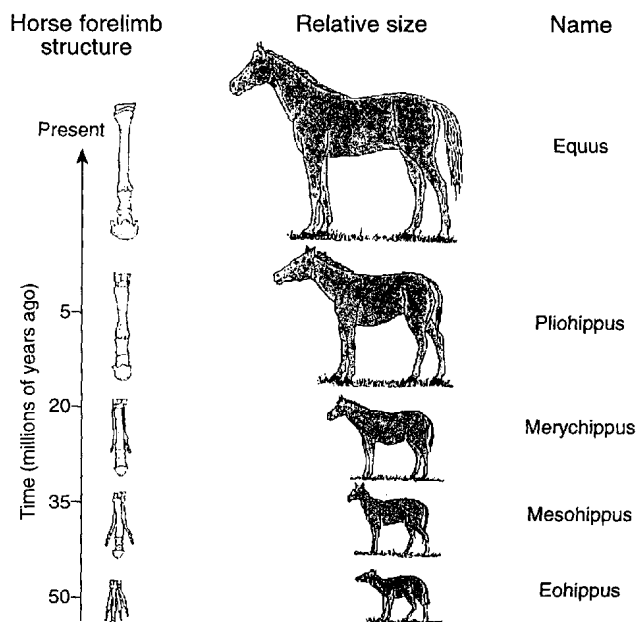
- 15 Base your answer to the following question on the diagram below, which represents a model of a radioactive sample with a half-life of 5000 years. The white boxes represent undecayed radioactive material and the shaded boxes represent the decayed material after the first half-life.

Radioactive Sample After First Half-Life



How many *more* boxes should be shaded to represent the additional decayed material formed during the second half-life?

- (1) 12 (2) 6 (3) 3 (4) 0
- 16 Base your answer to the following question on the diagram, which shows the evolutionary development of the horse, as supported by the fossil record.



Which statement best explains the changing appearance of the horse, as supported by the fossil record?

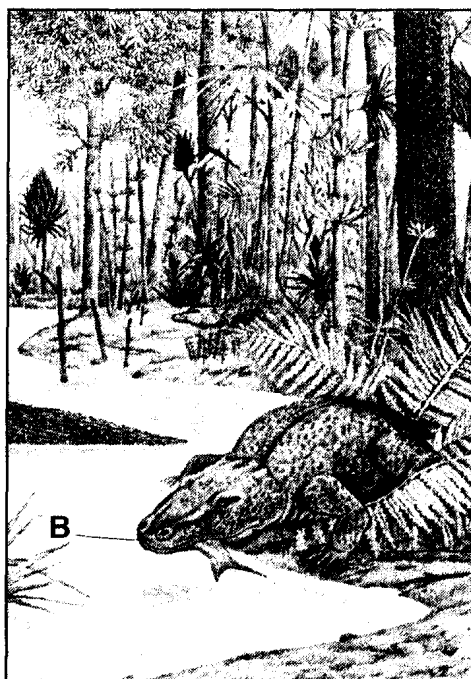
- (1) The horse evolved due to the influence of humans.
- (2) The horse evolved from a complex life-form to a simpler life-form.
- (3) The horse evolved into a life-form better able to survive.
- (4) The horse evolved from larger ancestors without forelimbs.

- 17 Base your answer to the following question on the diagrams below. Diagram 1 is a drawing of a seafloor environment during the Carboniferous Period. Diagram 2 is a drawing of a Carboniferous swamp-forest environment. Two organisms are labeled *A* and *B*.

**Diagram 1:
Carboniferous Seafloor**



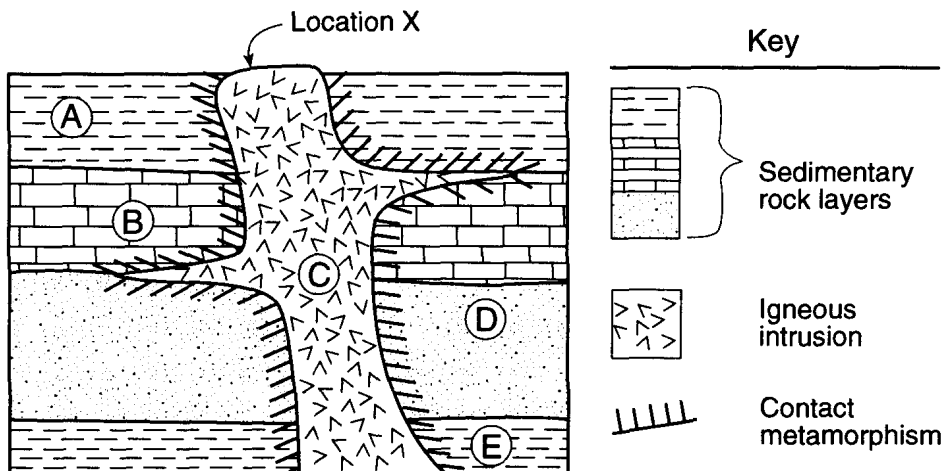
**Diagram 2:
Carboniferous Swamp-Forest**



Adapted from: Chet Raymo and Maureen Raymo,
Written in Stone: A Geological History of the Northeastern United States,
Second Edition, Black Dome Press Corp., 2001

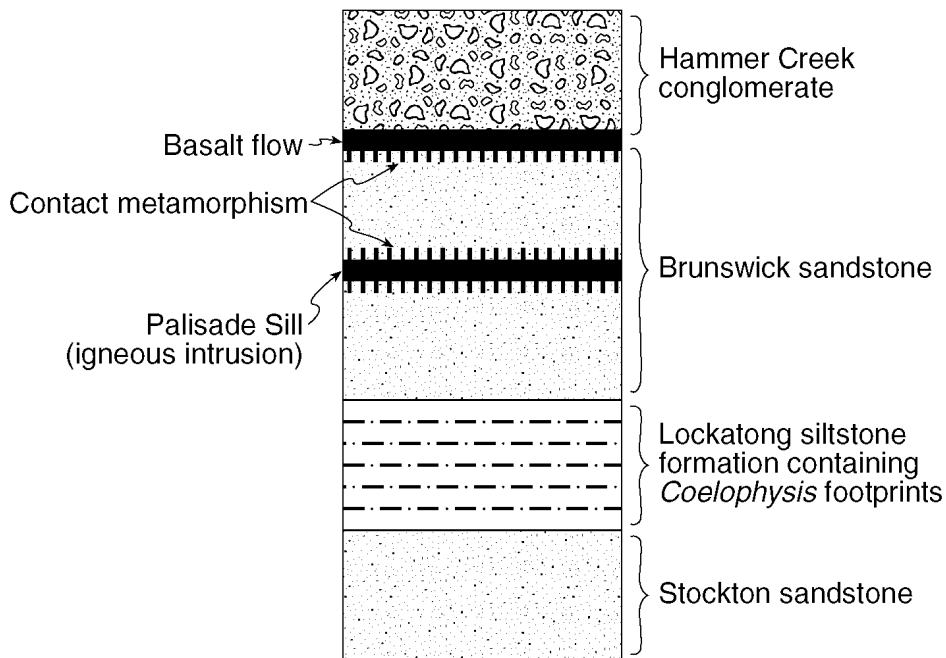
In which type of rock would fossils of organisms *A* and *B* most likely be found?

- (1) felsic igneous
(2) vesicular igneous
(3) clastic sedimentary
(4) nonfoliated metamorphic
- 18 Base your answer to the following question on the geologic cross section below. The cross section shows an outcrop in which the layers have not been overturned. Rock units are labeled *A* through *E*.

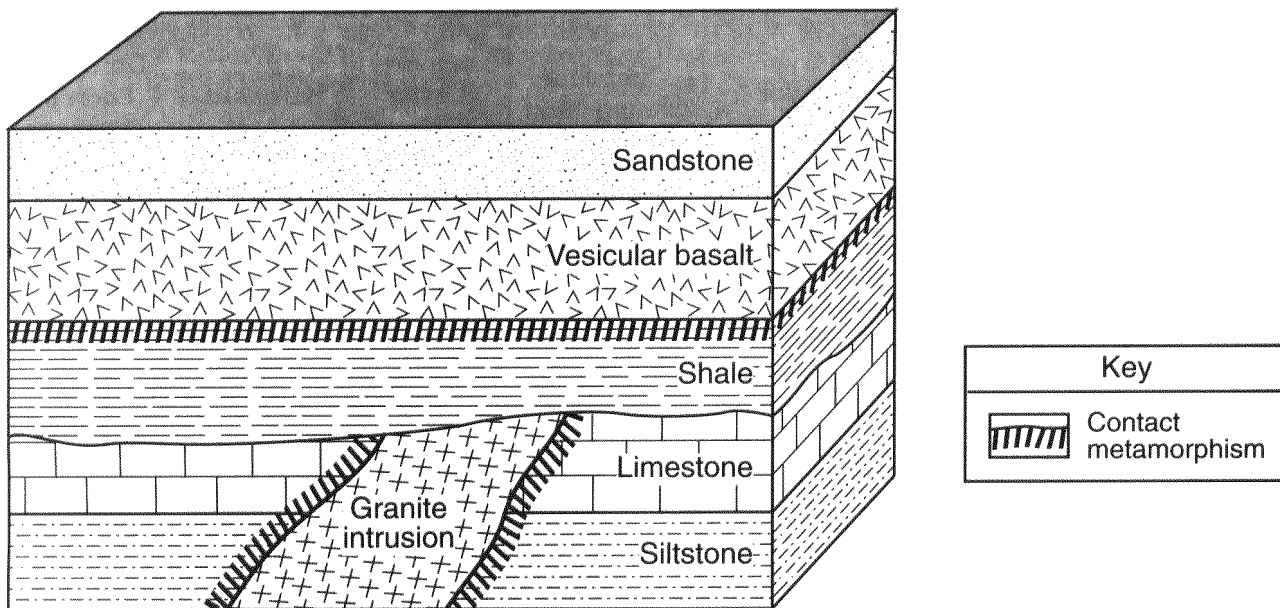


- ? Using letters *A* through *E*, list the rock units in order from oldest to youngest.

- 19 Base your answer to the following question on The cross section below, which shows several rock formations found in New York State. The rock layers have not been overturned.



- ? State one tectonic event affecting North America that occurred at the same time as the Palisade Sill intrusion.
- 20 Base your answer to the following question on The geologic cross section below. Radioactive dating indicates that the granite intrusion is 279 million years old and the vesicular basalt is 260 million years old. The rock layers have not been overturned.



- ? The granite intrusion caused part of the limestone layer to undergo metamorphism. What metamorphic rock would most likely be found in this zone of contact metamorphism?

1 Which is the major source of energy for most Earth processes?

- (1) radioactive decay within the Earth's interior
- (2) convection currents in the Earth's mantle
- (3) radiation received from the Sun
- (4) earthquakes along fault zones

2 Earth's atmosphere is warmed when

- (1) ultraviolet radiation emitted by Earth is absorbed by nitrogen and carbon dioxide in the atmosphere
- (2) x-ray radiation emitted by Earth is absorbed by nitrogen and carbon dioxide in the atmosphere
- (3) infrared radiation emitted by Earth is absorbed by carbon dioxide and water vapor in the atmosphere
- (4) gamma radiation emitted by Earth is absorbed by carbon dioxide and water vapor in the atmosphere

3 On a sunny day at the beach, the dark-colored sand gets hot while the water stays cool because the sand

- (1) reflects less energy and has a lower specific heat than the water
- (2) reflects less energy and has a higher specific heat than the water
- (3) reflects more energy and has a lower specific heat than the water
- (4) reflects more energy and has a higher specific heat than the water

4 What is the relative humidity when the dry-bulb temperature is 16°C and the wet-bulb temperature is 14°C ?

- (1) 90% (2) 80% (3) 14% (4) 13%

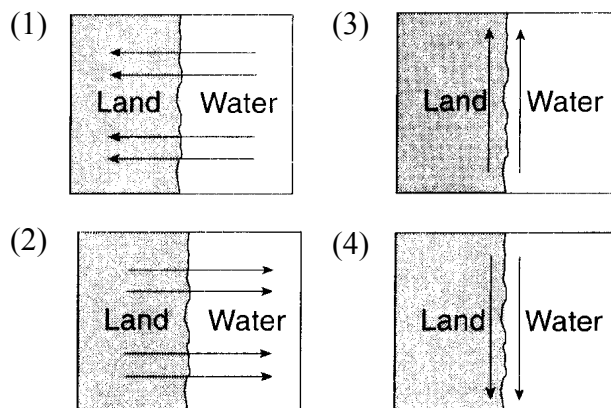
5 The properties of an airmass depend mainly on the

- (1) wind speed within the airmass
- (2) characteristics of the surface over which the airmass was formed
- (3) size of the airmass
- (4) rotation of the Earth

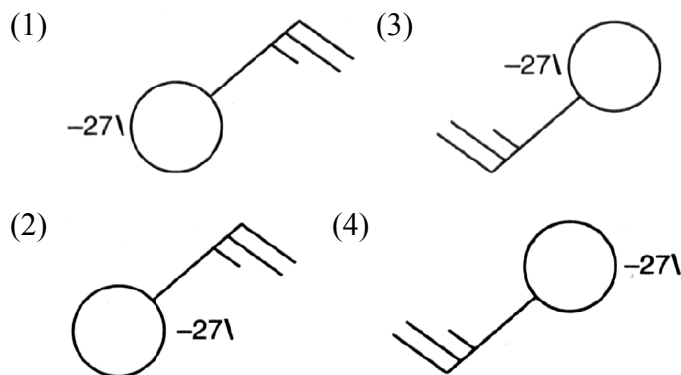
6 An observer measured the air temperature and the dewpoint and found the difference between them to be 12°C . One hour later, the difference between the air temperature and the dewpoint was found to be 4°C . Which statement best describes the changes that were occurring?

- (1) The relative humidity was decreasing and the chance of precipitation was decreasing.
- (2) The relative humidity was decreasing and the chance of precipitation was increasing.
- (3) The relative humidity was increasing and the chance of precipitation was decreasing.
- (4) The relative humidity was increasing and the chance of precipitation was increasing.

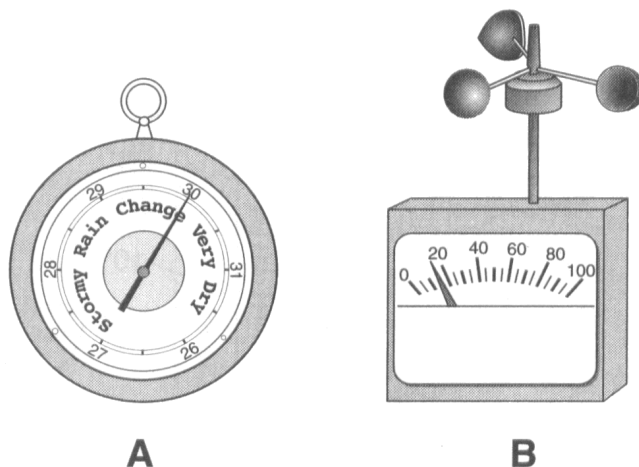
7 Adjacent water and landmasses are heated by the morning Sun on a clear, calm day. After a few hours, a surface wind develops. Which map best represents this wind's direction?



8 Which station model correctly represents the weather conditions in an area that is experiencing winds from the northeast at 25 knots and has had a steady drop in barometric pressure of 2.7 millibars during the last three hours?



9 The diagram below shows weather instruments *A* and *B*.



Which table correctly indicates the name of the weather instrument and the weather variable that it measures?

(1)

Instrument		Weather Variable Measured
Letter	Name	
A	thermometer	humidity
B	wind vane	wind direction

(3)

Instrument		Weather Variable Measured
Letter	Name	
A	barometer	wind speed
B	anemometer	air pressure

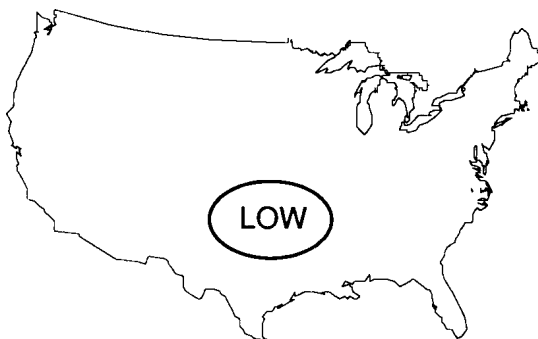
(2)

Instrument		Weather Variable Measured
Letter	Name	
A	thermometer	wind direction
B	wind vane	humidity

(4)

Instrument		Weather Variable Measured
Letter	Name	
A	barometer	air pressure
B	anemometer	wind speed

10 The map below shows a low-pressure system located over an area in the south-central United States.



In the next few days, because of the prevailing winds, the air mass will probably move toward the

- (1) southeast (2) northeast (3) southwest (4) northwest

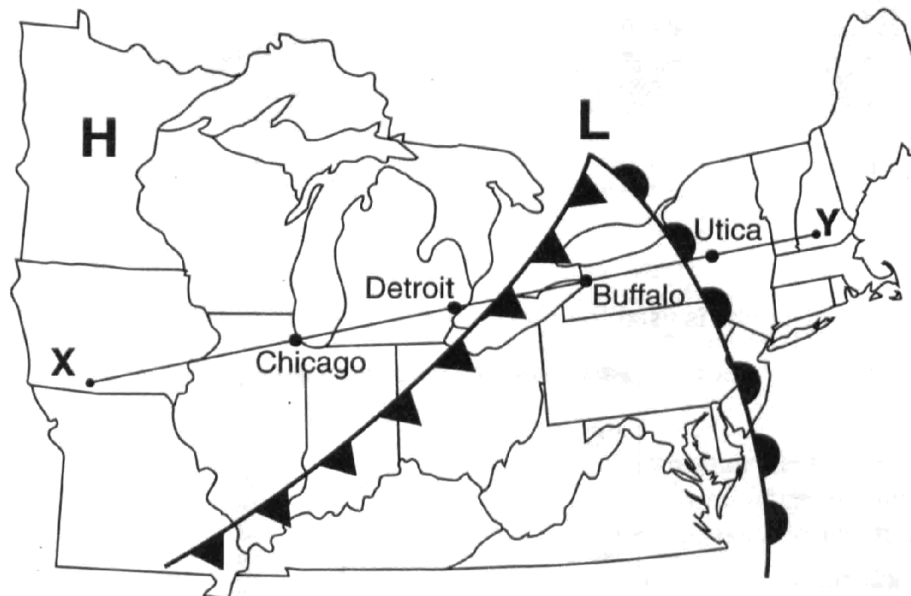
11 Under which set of atmospheric conditions does water usually evaporate at the fastest rate?

- (1) warm temperatures, calm winds, and high humidity
 (2) warm temperatures, high winds, and low humidity
 (3) cold temperatures, calm winds, and low humidity
 (4) cold temperatures, high winds, and high humidity


12 At which latitudes do currents of dry, sinking air cause the dry conditions of Earth's major deserts?

- (1) 0° and 30° N (3) 30° N and 30° S
 (2) 60° N and 60° S (4) 60° S and 90° S

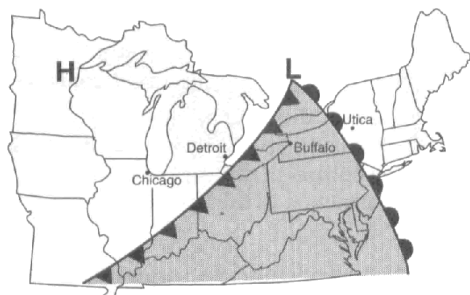
- 13 Base your answer to the following question on the weather map below, which shows a high-pressure center (**H**) and a low-pressure center (**L**), with two fronts extending from the low-pressure center. Points *X* and *Y* are locations on the map connected by a reference line.



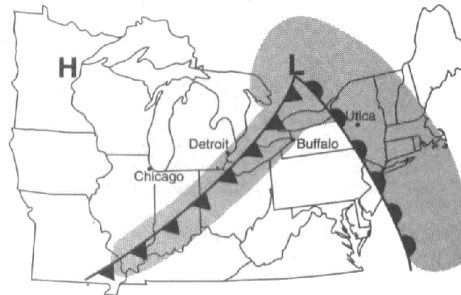
Which map best shows the most probable areas of precipitation associated with these weather systems?

Key	
	Precipitation

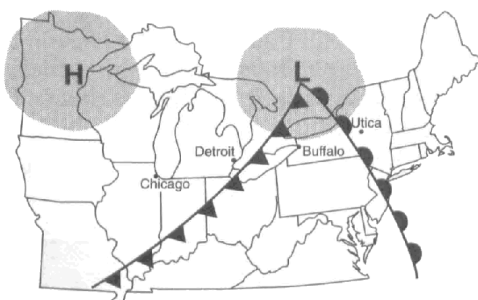
(1)



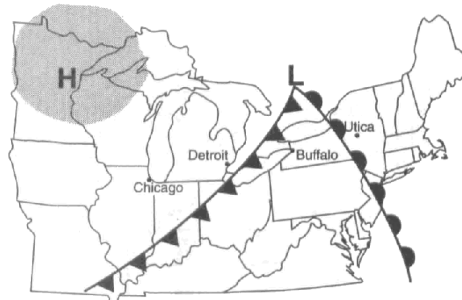
(3)



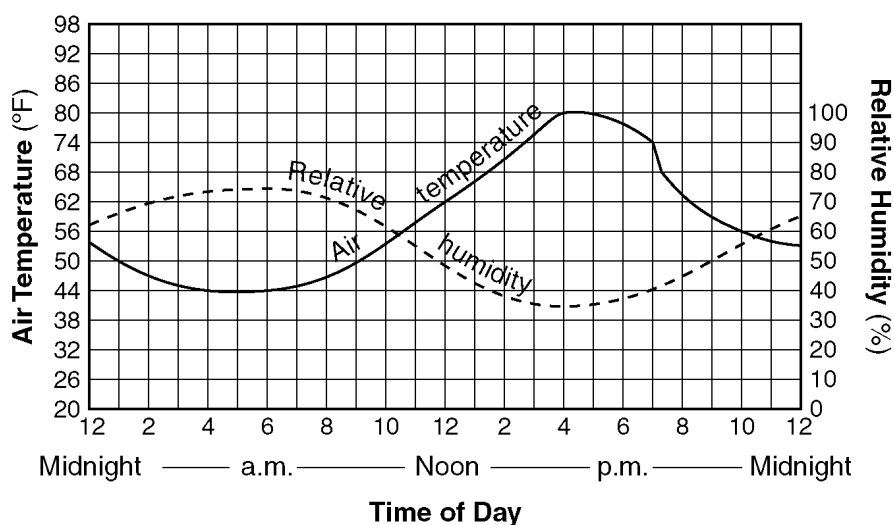
(2)



(4)

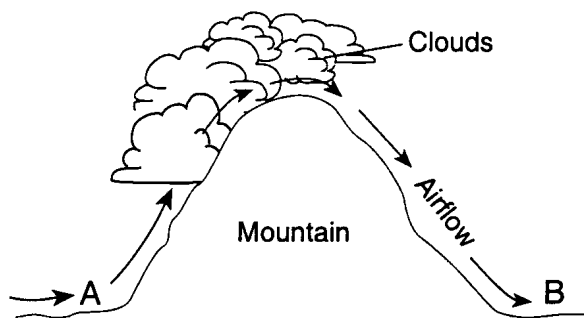


- 14 Base your answer to the following question on the graph below. The graph shows air temperature and relative humidity at a single location during a 24-hour period.



At which time would the rate of evaporation most likely be greatest?

- (1) 11 p.m. (2) 6 a.m. (3) 10 a.m. (4) 4 p.m.
- 15 Base your answer to the following question on the diagram of a mountain shown below. The arrows represent the direction of airflow over the mountain.



Compared to the temperature and humidity conditions at location A, the conditions at location B are

- (1) warmer and less humid (3) cooler and less humid
(2) warmer and more humid (4) cooler and more humid

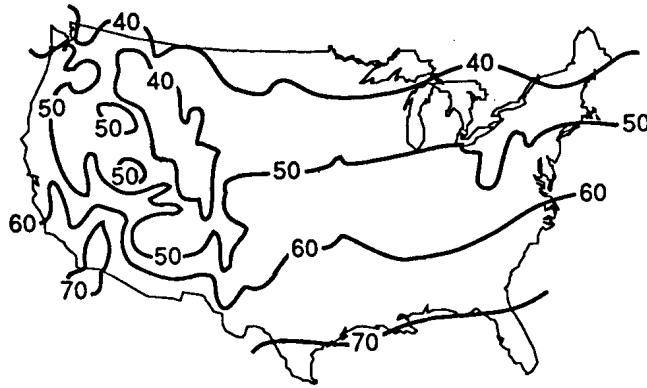
- 16 Compared to the climate conditions of dry inland locations, the climate conditions of locations influenced by a nearby ocean generally result in

- (1) hotter summers and colder winters, with a larger annual range of temperatures
(2) hotter summers and colder winters, with a smaller annual range of temperatures
(3) cooler summers and warmer winters, with a larger annual range of temperatures
(4) cooler summers and warmer winters, with a smaller annual range of temperatures

- 17 If large amounts of dust are added to the atmosphere, the average air temperature will most likely

- (1) decrease due to increased reflection of insolation
(2) decrease due to increased infrared absorption
(3) increase due to increased reflection of insolation
(4) increase due to increased infrared absorption

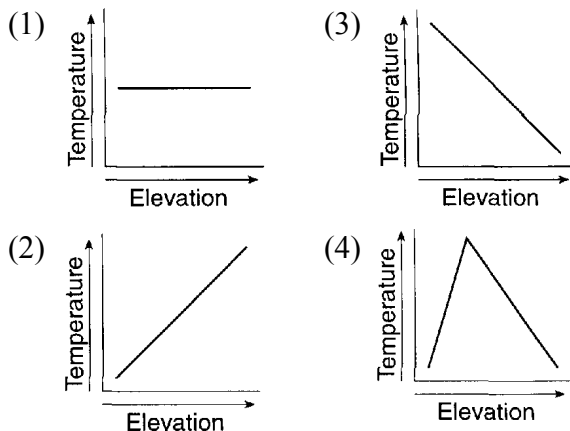
18 The map below shows average annual temperatures in degrees Fahrenheit across the United States.



Which climatic factor is most important in determining the pattern shown in the eastern half of the United States?

- (1) ocean currents
- (2) mountain barriers
- (3) elevation above sea level
- (4) latitude

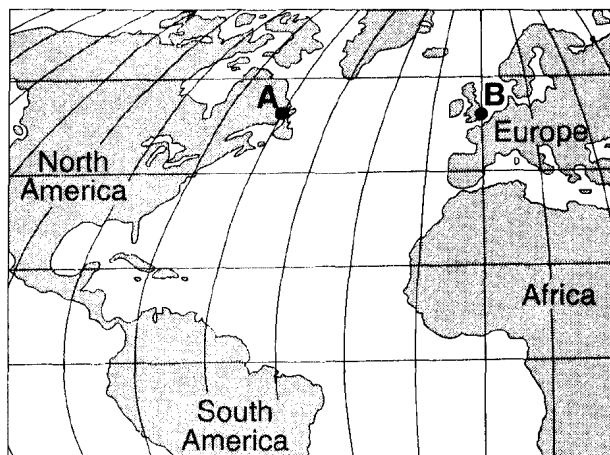
19 Which graph best shows the general effect that differences in elevation above sea level have on the average annual temperature?



20 Which list correctly matches each instrument with the weather variable it measures?

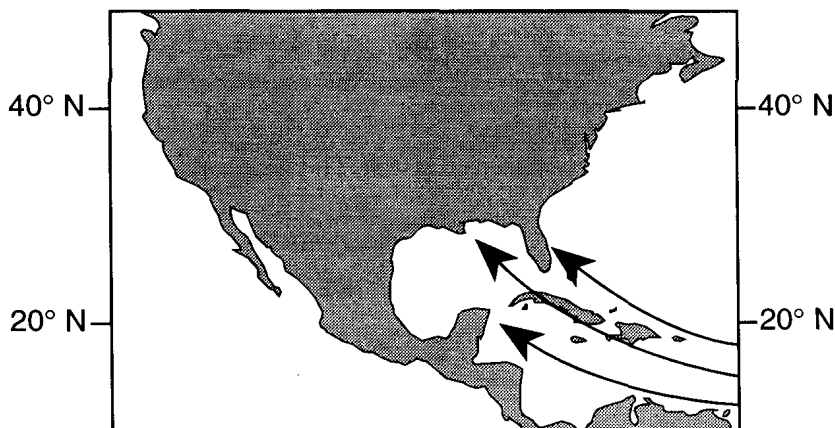
- (1) wind vane—wind speed
thermometer—temperature
precipitation gauge—relative humidity
- (2) wind vane—wind direction
thermometer—dewpoint
psychrometer—air pressure
- (3) barometer—relative humidity
anemometer—cloud cover
precipitation gauge—probability of precipitation
- (4) barometer—air pressure
anemometer—wind speed
psychrometer—relative humidity

- 21 Base your answer to the following question on the map below, which shows locations *A* and *B* on Earth's surface at the same distance from the ocean, at the same elevation above sea level, and at the same latitude.



Which statement best explains why location *A* has a cooler climate than location *B*?

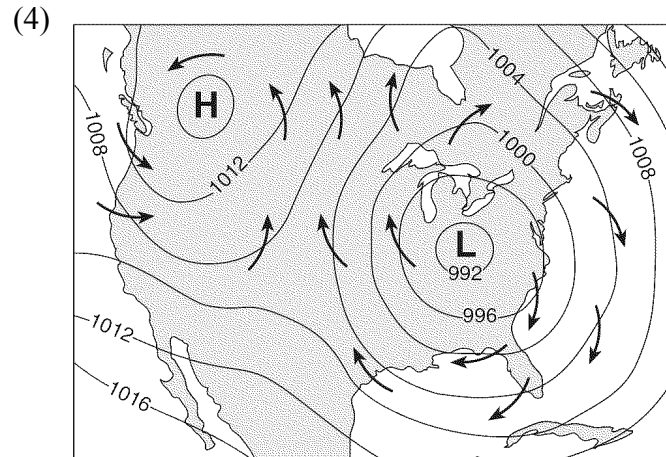
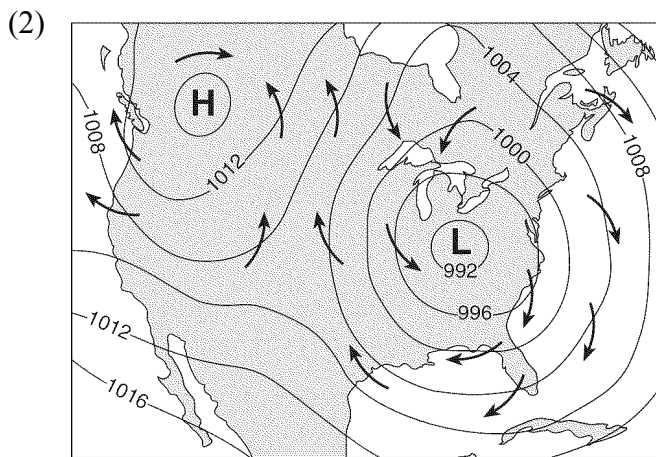
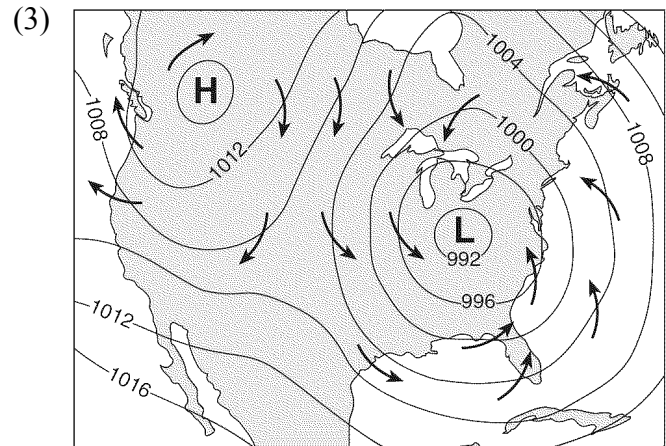
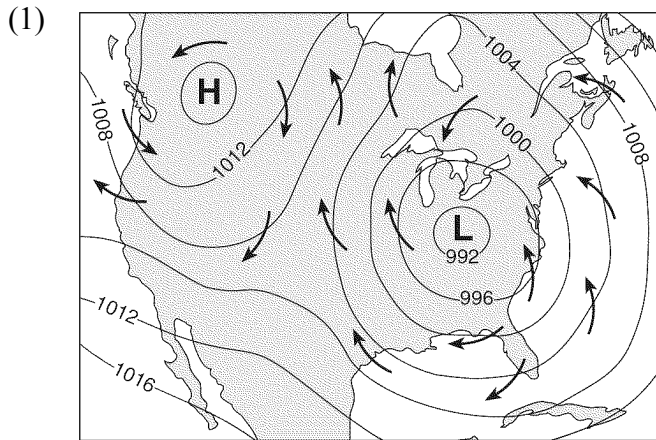
- (1) Location *A* has a longer duration of insolation each day.
 - (2) Location *A* is influenced by a cold ocean current.
 - (3) Location *B* is farther from the equator.
 - (4) Location *B* has less intense insolation each day.
- 22 The map below shows part of North America.



The arrows shown on the map most likely represent the direction of movement of

- (1) Earth's rotation
- (2) the prevailing northeast winds
- (3) ocean conduction currents
- (4) Atlantic Ocean hurricanes

23 Which map best represents the direction of surface winds associated with the high-pressure and low-pressure systems?

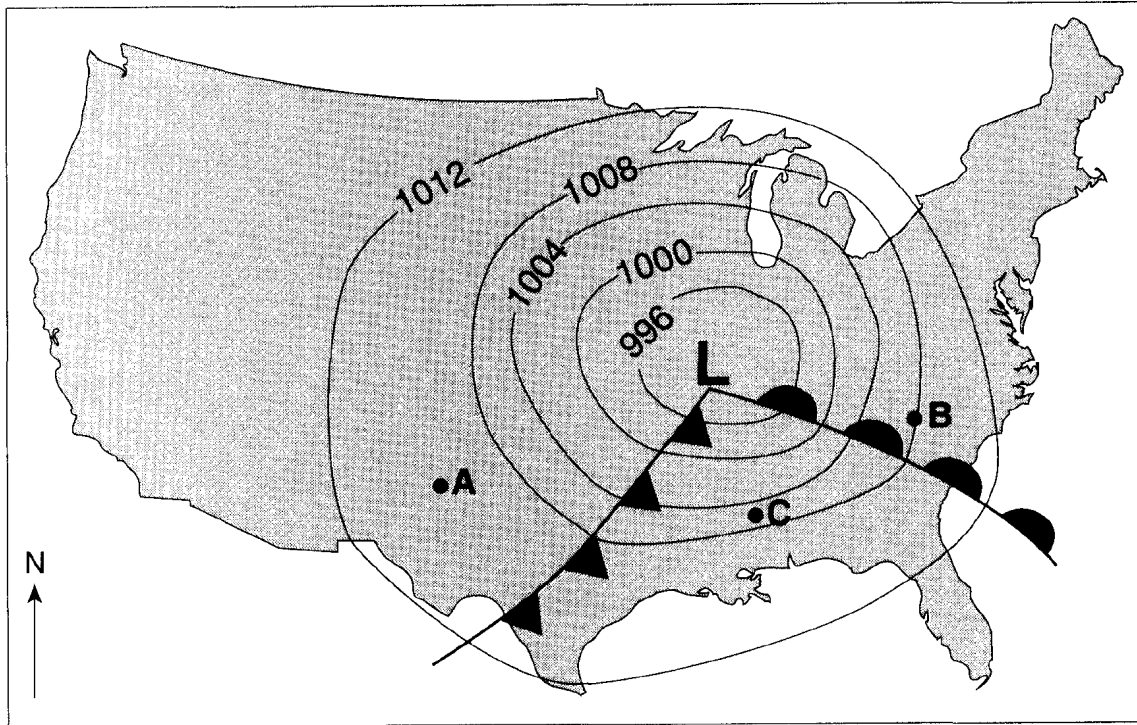


- 24 Base your answer to the following question on the weather map below, which shows two fronts associated with a low-pressure system.



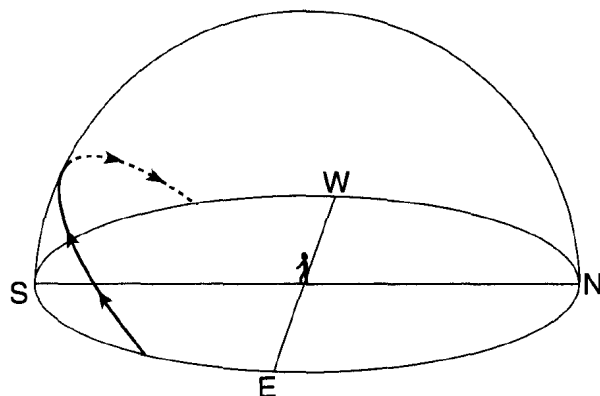
Warm, moist air is rising along the two frontal surfaces. Describe how the water vapor in this rising air forms clouds. Include *dewpoint* and *condensation* in your answer.

- 25 Base your answer to the following question on the weather map below, which shows a low-pressure system located over central United States. Points A, B, and C represent locations on Earth's surface. The isobars on the map show air pressures in millibars.



- ? What evidence shown on the weather map indicates that point C is experiencing greater wind speeds than point A?

1 The model below shows the Sun's apparent path across the sky for an observer in New York State.



On which day of the year was this path observed?

- (1) March 21 (2) June 21 (3) September 21 (4) December 21

2 Which motion causes the constellation Orion to be visible at midnight from New York State in winter but not in summer?

- (1) rotation of Earth (3) revolution of Earth
(2) rotation of Orion (4) revolution of Orion

3 The best evidence that Earth rotates is provided by the

- (1) location of mid-oceanic ridge volcanoes and the distribution of index fossils
(2) movement of Foucault pendulums and the Coriolis effect on air movement
(3) pattern of changing seasons and the depth of meteor impacts
(4) rate of uranium-238 decay and changes in atmospheric composition

4 Compared to the Jovian planets, terrestrial planets are

- (1) more dense and more massive.
(2) less dense and more massive.
(3) more dense and less massive.
(4) less dense and less massive.

5 What is the inferred age of our solar system, in millions of years?

- (1) 544 (3) 4600
(2) 1300 (4) 10,000

6 In a Doppler red shift, the observed wavelengths of light from distant celestial objects appear closer to the red end of the spectrum than light from similar nearby celestial objects. The explanation for the red shift is that the universe is presently

- (1) contracting, only
(2) expanding, only
(3) remaining constant in size
(4) alternating between contracting and expanding

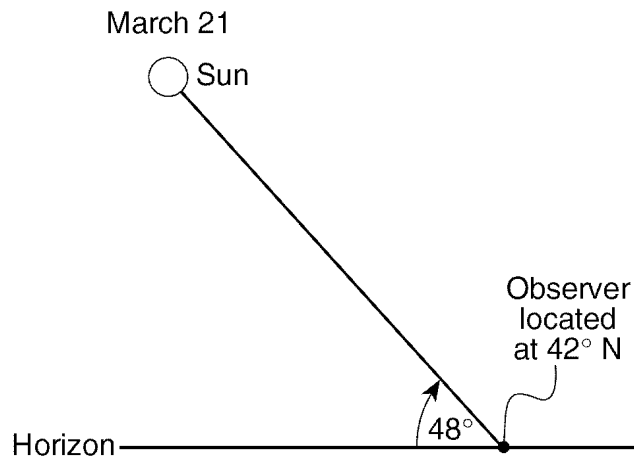
7 Compared to the temperature and luminosity of the star *Polaris*, the star *Sirius* is

- (1) hotter and more luminous
(2) hotter and less luminous
(3) cooler and more luminous
(4) cooler and less luminous

8 In which list are celestial features correctly shown in order of increasing size?

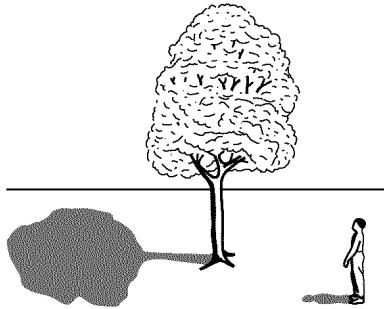
- (1) galaxy → solar system → universe → planet
(2) solar system → galaxy → planet → universe
(3) planet → solar system → galaxy → universe
(4) universe → galaxy → solar system → planet

- 9 The diagram below shows the altitude of the Sun at solar noon on March 21, as seen by an observer at 42° N latitude.



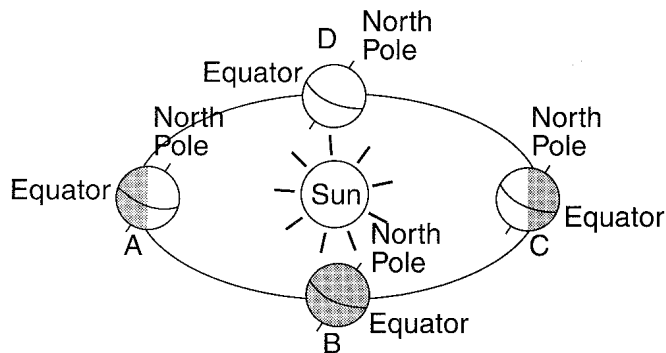
Compared to the altitude of the Sun observed at solar noon on March 21, the altitude of the Sun observed at solar noon on June 21 will be

- (1) 15° higher in the sky (3) 42° higher in the sky
 (2) 23.5° higher in the sky (4) 48° higher in the sky
- 10 The diagram below shows the noontime shadows cast by a student and a tree.



If the time is solar noon and the student is located in New York State, in what direction is the student facing?

- (1) north (2) south (3) east (4) west
- 11 The diagram below represents Earth at four different positions, *A*, *B*, *C*, and *D*, in its orbit around the Sun.

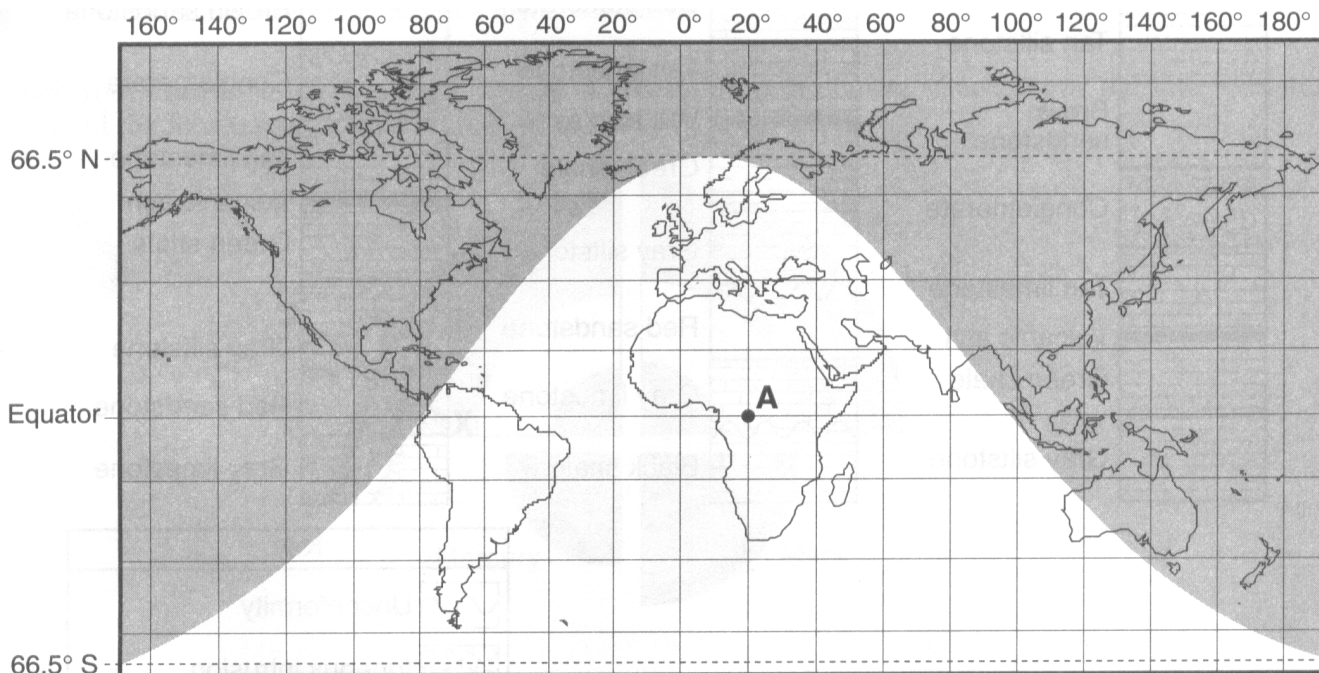


(Not drawn to scale)

Between which positions would Texas be experiencing the summer season?

- (1) *A* and *B* (2) *B* and *C* (3) *C* and *D* (4) *D* and *A*

Base your answer to questions 6 and 7 on the world map below. The shaded portion of the map indicates areas of night, and the unshaded portion indicates areas of daylight on a certain day of the year. Dashed latitude lines represent the Arctic Circle (66.5° N) and the Antarctic Circle (66.5° S). Point *A* is a location on Earth's surface.



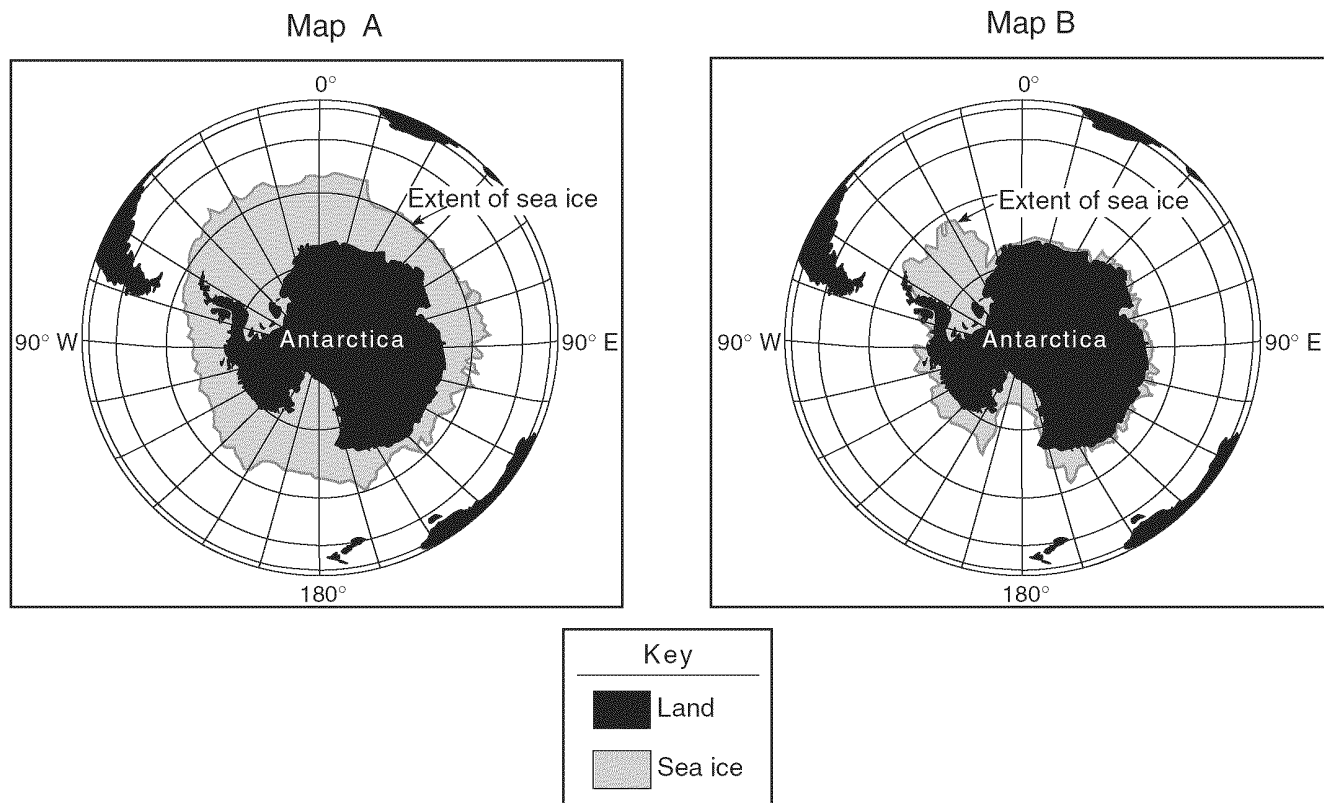
12" Approximately how many hours of daylight would occur at position *A* on this day?

- (1) 6 (2) 9 (3) 12 (4) 15

13" Which diagram shows the position of Earth relative to the Sun's rays on this day?

- (1)
- (2)
- (3)
- (4)

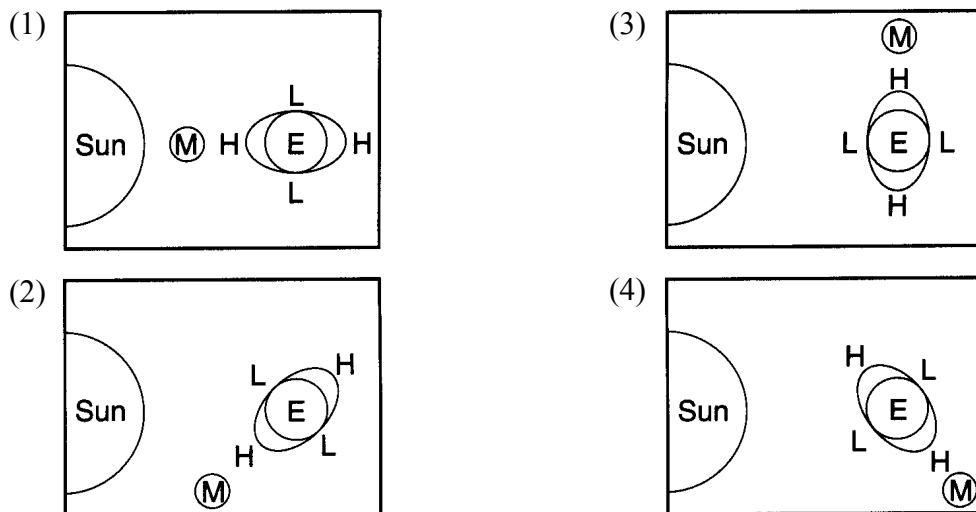
- 14 The maps below show the amount of sea ice surrounding the continent of Antarctica at two different times of the year. Map *A* represents late August when the area covered by sea ice approaches its greatest extent. Map *B* represents the minimum extent of sea ice.



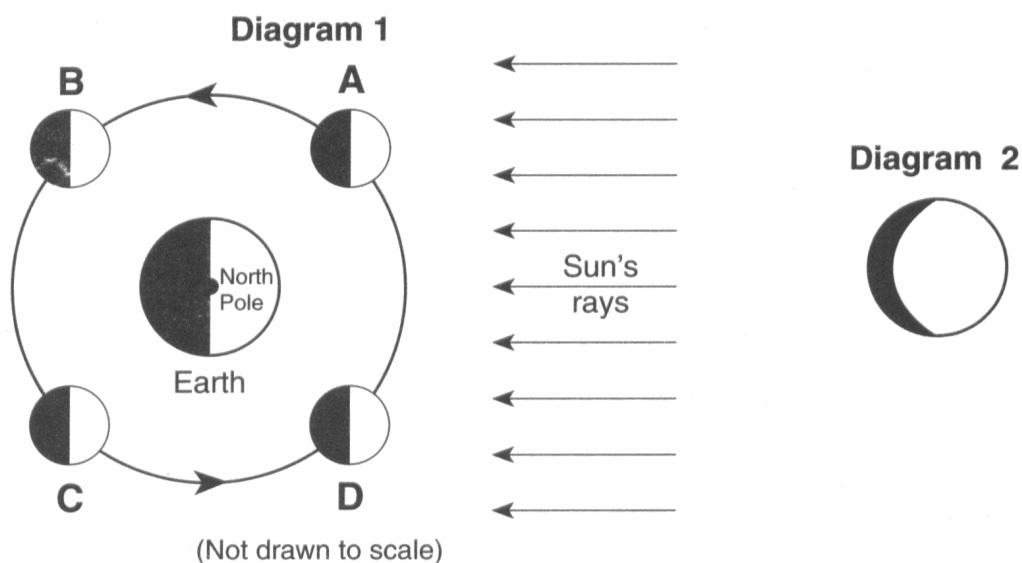
Which month is most probably represented by map *B*?

- (1) February (2) May (3) June (4) October
- 15 The diagrams below represent Earth's ocean tides at four different positions of the Moon. Which diagram shows the Moon position that will produce the highest high tides and the lowest low tides? (The diagrams are not drawn to scale.)

Key			
E = Earth		H = High tide	
M = Moon		L = Low tide	

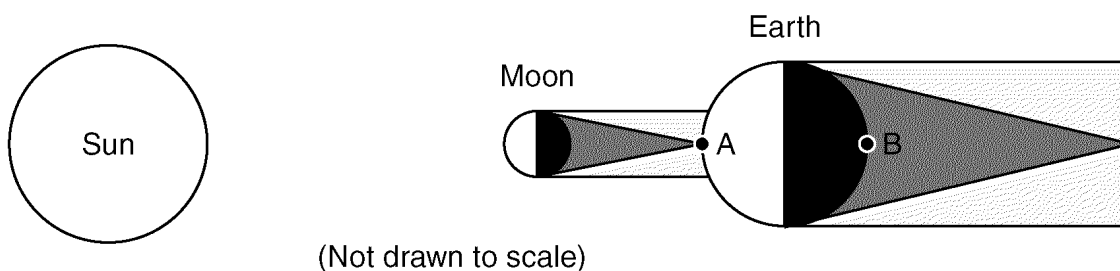


- 16 Diagram 1 shows the Moon in its orbit at four positions labeled A, B, C, and D. Diagram 2 shows a phase of the Moon as viewed from New York State.



At which labeled Moon position would the phase of the Moon shown in diagram 2 be observed from New York State?

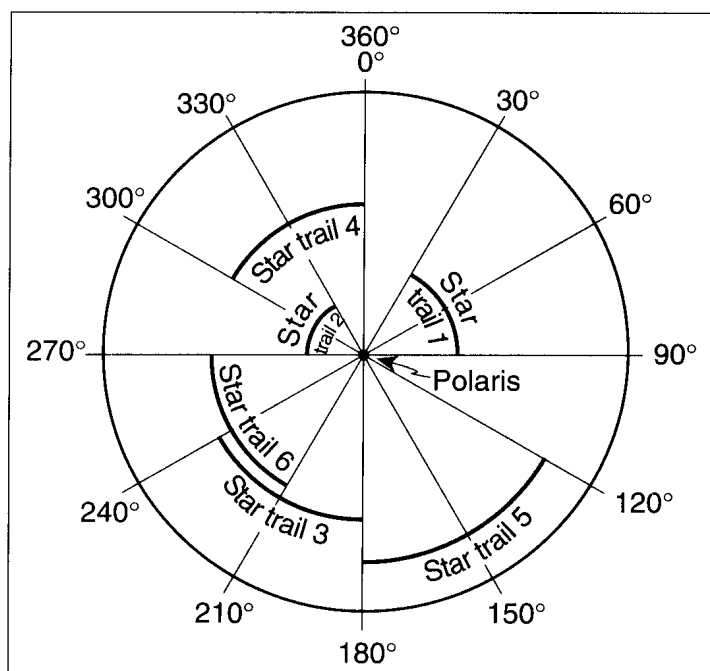
- (1) *A* (2) *B* (3) *C* (4) *D*
- 17 The diagram below shows the relative positions of the Sun, the Moon, and Earth when an eclipse was observed from Earth. Positions *A* and *B* are locations on Earth's surface.



Which statement correctly describes the type of eclipse that was occurring and the position on Earth where this eclipse was observed?

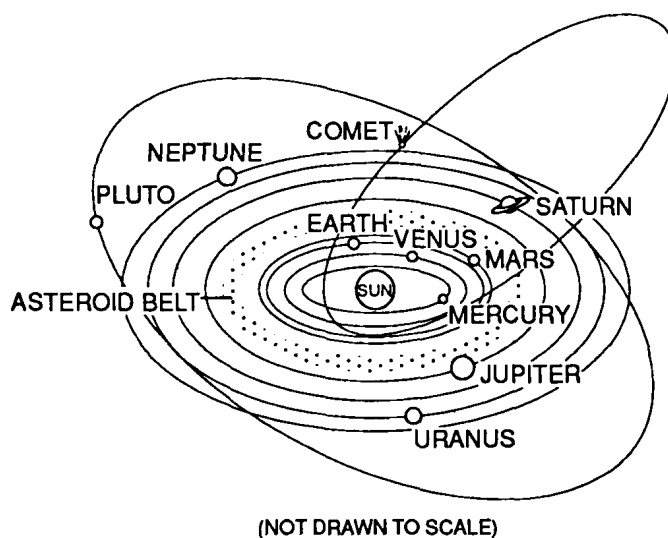
- (1) A lunar eclipse was observed from position *A*.
 (2) A lunar eclipse was observed from position *B*.
 (3) A solar eclipse was observed from position *A*.
 (4) A solar eclipse was observed from position *B*.

- 18 A camera was placed outside at night and pointed directly at *Polaris* and several other stars. The lens was kept open and a time-exposure photograph was taken. The diagram below represents that photograph of *Polaris* and star trails, with an angular protractor to measure apparent motion.



How many hours was the lens kept open to create the star trails in this photograph?

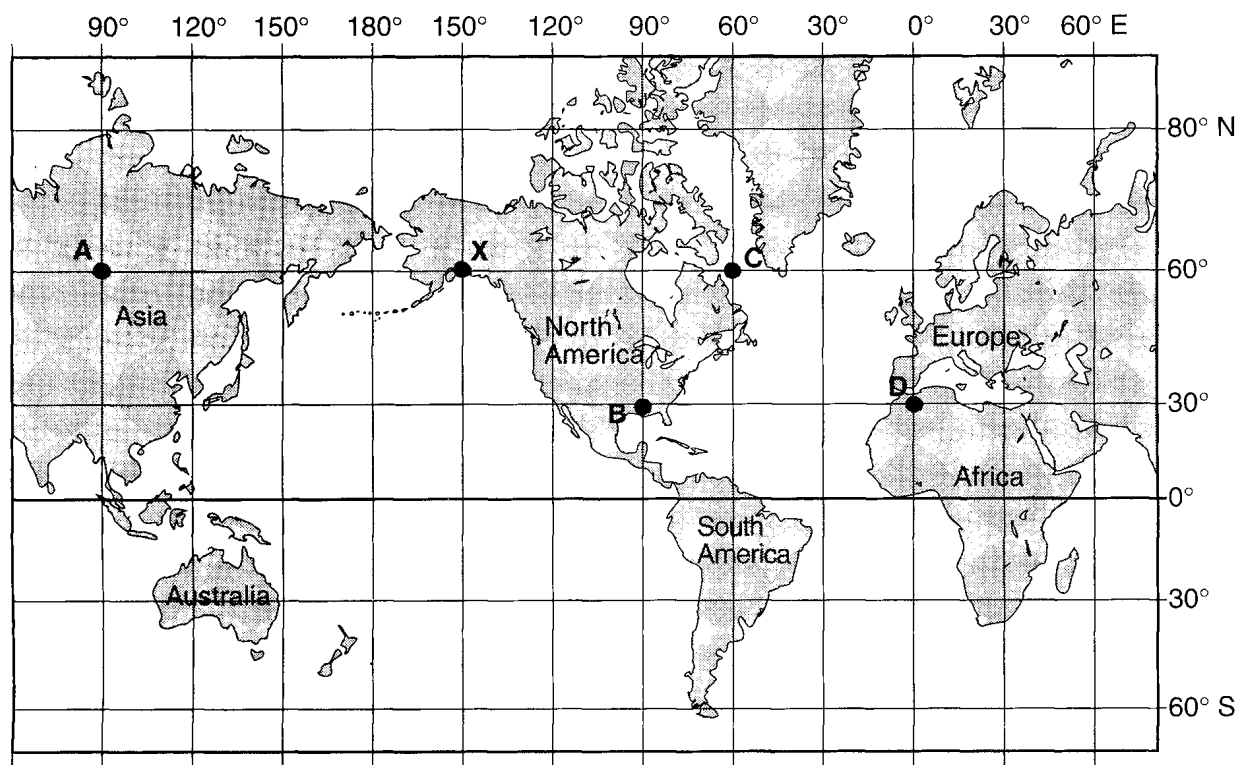
- (1) 1 hour (2) 6 hours (3) 3 hours (4) 4 hours
- 19 The diagram below represents our solar system.



This system is best classified as

- (1) geocentric, with elliptical orbits (3) heliocentric, with elliptical orbits
(2) geocentric, with circular orbits (4) heliocentric, with circular orbits

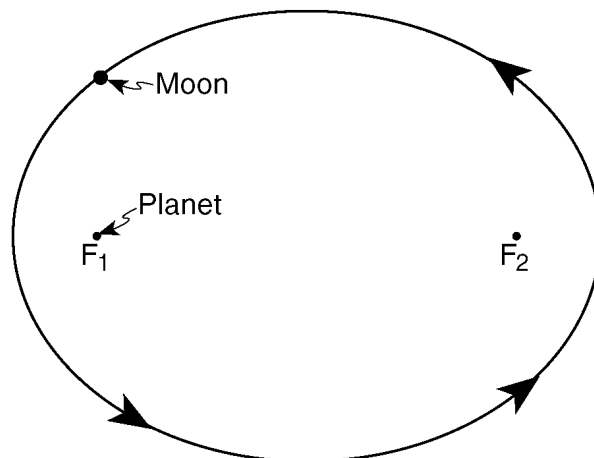
20 Letters A, B, C, D, and X on the map below represent locations on Earth. The map shows the latitude-longitude grid.



Solar time is based on the position of the Sun. If the solar time is 1 p.m. at location X, at which location is the solar time 5 p.m.?

- (1) A (2) B (3) C (4) D

21 The diagram below represents the elliptical orbit of a moon revolving around a planet. The foci of this orbit are the points labeled F_1 and F_2 .

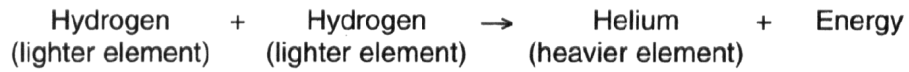


(Drawn to scale)

What is the approximate eccentricity of this elliptical orbit?

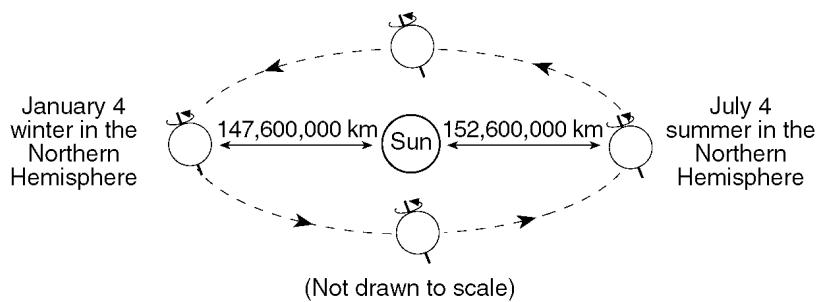
- (1) 0.3 (2) 0.5 (3) 0.7 (4) 1.4

22 The reaction below represents an energy-producing process.



The reaction represents how energy is produced

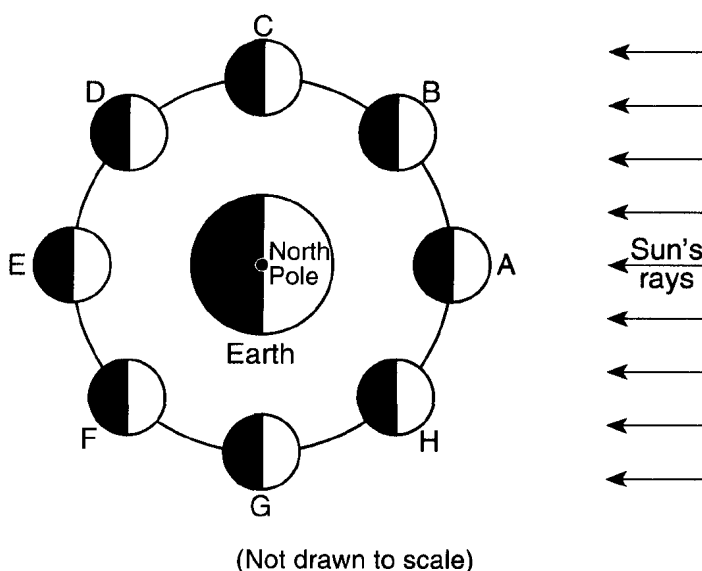
- (1) in the Sun by fusion
 - (2) when water condenses in Earth's atmosphere
 - (3) from the movement of crustal plates
 - (4) during nuclear decay
- 23 the diagram below, which shows a model of Earth's orbit around the Sun. Two motions of Earth are indicated. Distances to the Sun are given for two positions of Earth in its orbit.



Key	
Earth motions	
-->	Revolution
↻	Rotation

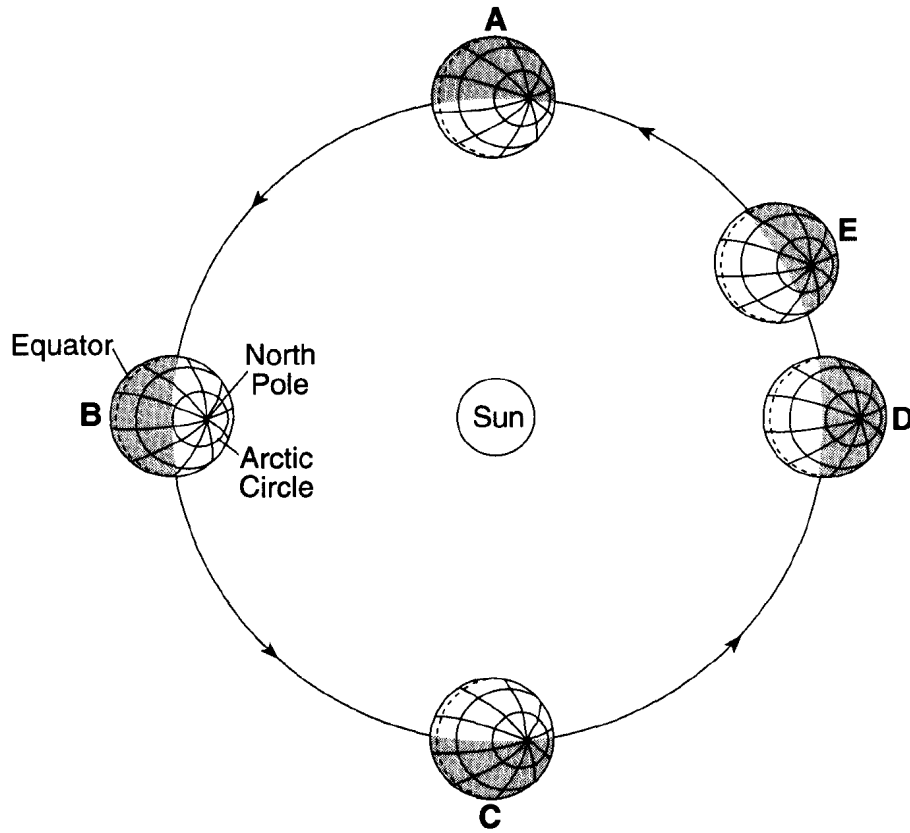
? Explain why Canada experiences summer when Earth is at its greatest distance from the Sun.

24 Base your answer to the following question on the diagram below, which shows the Moon at positions A through H in its orbit around Earth.

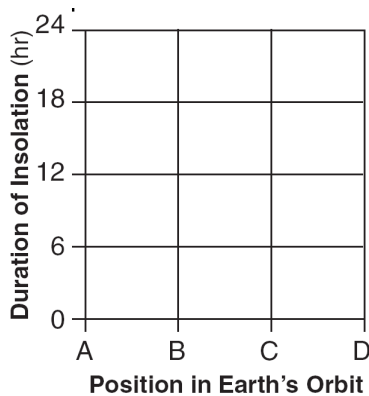


? How many days does it take for the Moon to complete one cycle of phases as viewed from Earth?

- 25 Base your answer to the following question on on the diagram below, which shows the parts of Earth experiencing daylight and darkness as Earth orbits the Sun. Letters A, B, C, D, and E are positions in Earth's orbit as viewed from above the Northern Hemisphere.



(Not drawn to scale)



On the grid, place **Xs** to show the duration of insolation at the Arctic Circle for each position in Earth's orbit.

25 [1] Allow 1 credit if all four Xs are plotted within the circles shown and are connected with a line that passes through the circles.

Example of a correct response for question 25:

